Additives & Instruments

Substance for Success.

Technical Information PVC-TI 2

Wetting and Dispersing Additives

PVC Plastisol Applications

A member of ALTANA

Wetting and Dispersing Additives

Content

DISPERPLAST Wetting and Dispersing Additive

Wetting and dispersing additives correct the deficiencies that occur during the dispersion process. During dispersion of particles in plasticizers, the interactive forces between the particles result in long dispersion times, pigment streaks, flooding and floating and high viscosity (figure 1).

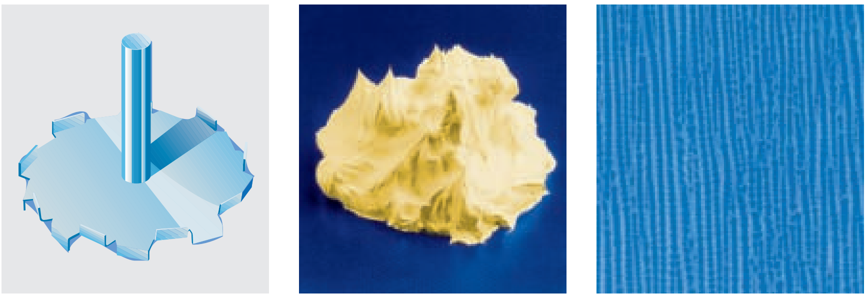
During dispersion, the introduction of energy breaks down agglomerates into individual particles. If the system is not stabilized, the finely distributed particles reagglomerate and form flocculates (figure 2).
DISPERPLAST wetting and dispersing additives adsorb onto the surface of the pigment/filler particles.
They then separate particles from each other and stabilize the system by forming an organic adsorption layer that is compatible with the plasticizers.

One logical method of classifying the many wetting and dispersing additives is to classify them according to the chemical structure (anionic, cationic or electroneutral) of their pigment affinic groups. In practice, it is also important to classify based on whether the additive is compatible with plasticizer/solvent or water-borne systems. Another classification, which is often helpful in practice, is to identify whether the additives stabilize the **deflocculated** or **flocculated** state.

Low-Molecular Weight, Mono-Functional Wetting and Dispersing Additives to Reduce Viscosity

The structure of the classic deflocculating additives have spatially pigment/filler affinic groups and plasticizer compatible groups. Such additives are low-molecular weight polymers that adsorb on the pigment/filler surface.
This results in a reduction of interactive forces between pigment/filler particles which in turn leads to a strong viscosity reduction of the pigment/filler paste (figure 3).

Potential Problems



Long dispersion times — High viscosities — Pigment streaks

figure 1

Dispersion Process

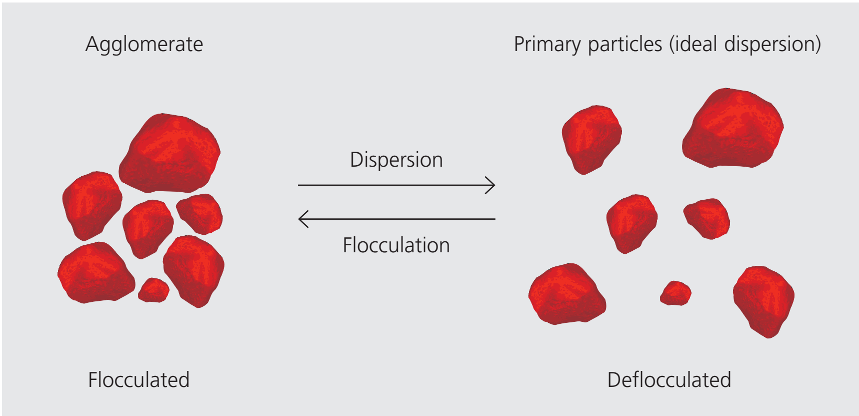


figure 2

Viscosity Reduction
DISPERPLAST-1142, DISPERPLAST-1148 and DISPERPLAST-1150

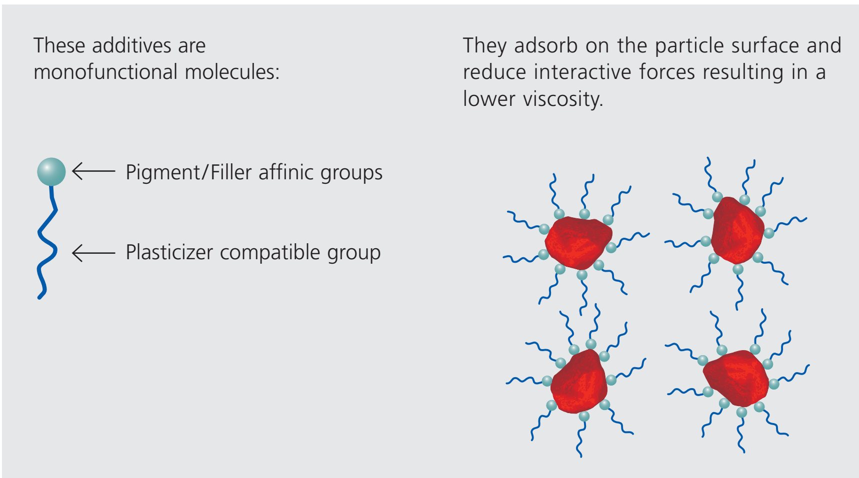


figure 3

Low-molecular Weight, Bi-Functional Wetting and Dispersing Additives to Reduce Viscosity and to Reduce Settling

If the pigment affinic groups are not merely confined to a small region of the additive molecule, but are distributed in a special fashion over the molecule – then such an additive can function as a bridge between various pigment particles. Because of the additive's design, three-dimensional wetting structures are formed as shown in the **pigment flocculate** diagram portion of figure 4. The size and stability of such flocculates are determined by the additive – in particular, through the additive-additive and additive-pigment interactions. In this case, **controlled** flocculation states occur in which the degree of flocculation is dependent upon the chemical structure and the usage level of the additive. Also in this chemical structure, the single pigment particles (because of the additive molecules) remain separated from each other. This type of pigment stabilization leads to different PVC plastisol properties than in the case of deflocculation of the pigments. This is described in more detail in the following sections. In each situation it must be decided which kind of stabilization is more advantageous.

Viscosity Reduction and Anti-Settling DISPERPLAST-I, DISPERPLAST-P

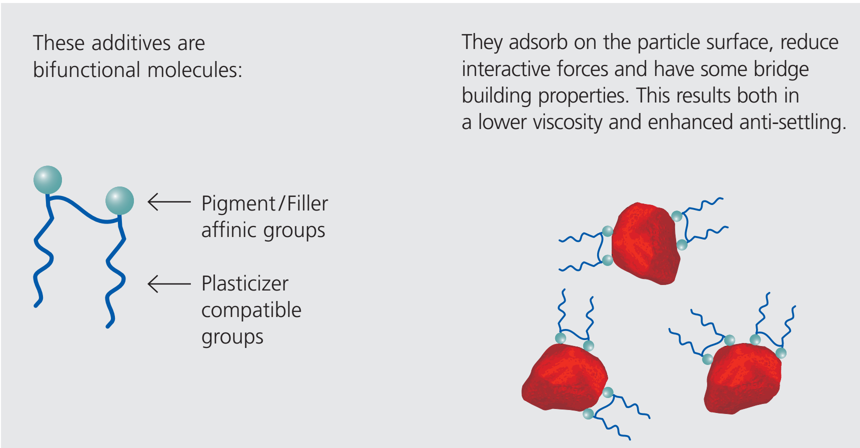


figure 4

Viscosity Reduction and Color Stability BYK-9076, BYK-9077

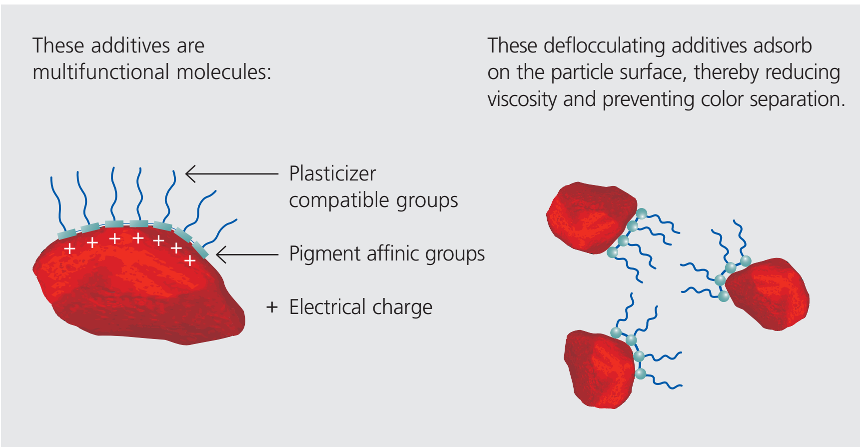


figure 5

High Molecular Weight Polymeric Wetting and Dispersing Additives

In order for additives to be effective, a durable and permanent adsorption onto the pigment surface is of utmost importance. The surface properties of the pigment particles are therefore crucial to the additive´s effectiveness. **Inorganic pigments** are ionically constructed and display relatively high surface polarities, thus making adsorption of the additives relatively easy. With **organic pigments,** however, the pigment crystals are composed of individual molecules which themselves are dominantly nonpolar. As a result, organic pigments have very nonpolar surfaces and therefore make proper adsorption of conventional additives rather difficult. In practice, this means that organic pigments are insufficiently deflocculated and stabilized by traditional wetting and dispersing additives. For this reason, a new group of additives has been developed over the past few years – high molecular weight polymeric wetting and dispersing additives (figure 5). Such additives differentiate themselves from the conventional low molecular weight polymers through considerably higher molecular weights which allow the attainment of a resin-like character.
In addition, the newer additives contain a higher number of adhesion groups. The electrostatic repulsion effects play an important role in the stability state of the pigment dispersion.
The additives provide equal electrical charge to pigments, avoiding the possibility of the coflocculation of pigments that are not charged.

The recommended usage levels of the high molecular weight polymers are considerably higher than those of the classical low molecular weight molecules. Even though the polymeric wetting and dispersing additives were developed for organic pigments, they may also be utilized equally as well with inorganic pigments.

Benefits of DISPERPLAST

- reduced flooding and floating
- improved flow behavior
- improved glass/synthetic fiber penetration/wetting
- higher pigment loading at lower/ constant viscosity
- shorter dispersion times
- increased throughput
- improved color consistency from batch to batch
- faster color matching
- greater color strength and hiding power
- longer storage stability of dispersions

Improved Flow Behavior of Blow Mix Formulation Containing Azodicarbonamide, TiO_2, ZnO and Plasticizer

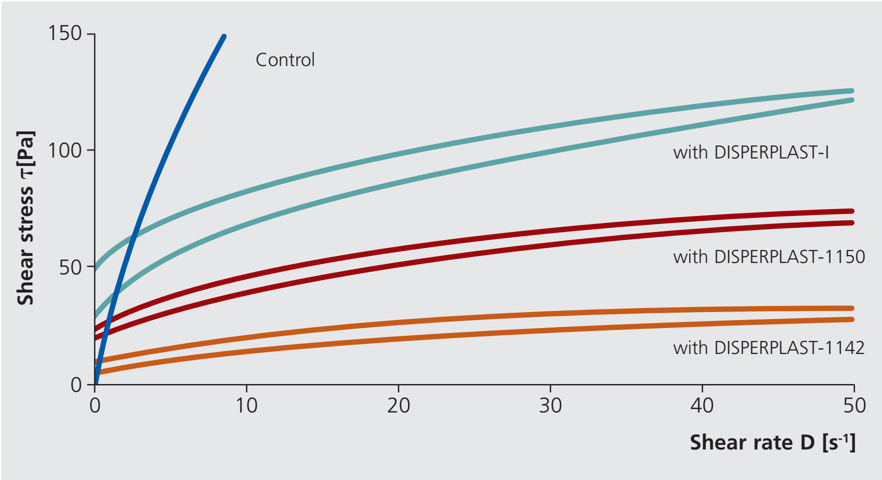


figure 6

Better Penetration of Glass Fibers using DISPERPLAST-1142

Black colored plastisol
without DISPERPLAST-1142
Glass fibers still visible

Black colored plastisol
with DISPERPLAST-1142
Glass fibers totally impregnated

figure 7

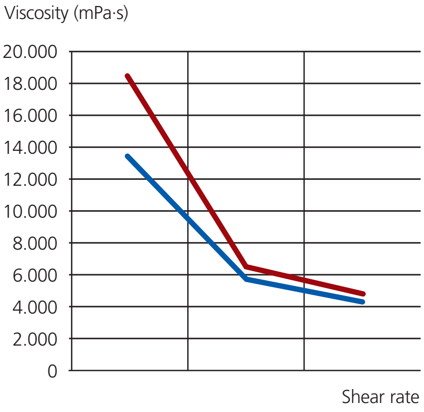
Better Handling with Increased Pigment Loading using DISPERPLAST-1150

50 % TiO_2 in DINP
without DISPERPLAST
not pumpable

70 % TiO_2 in DINP with
1.0 % DISPERPLAST-1150
pourable and pumpable

figure 8

Viscosity Reduction of a Foamed Wallcovering Plastisol

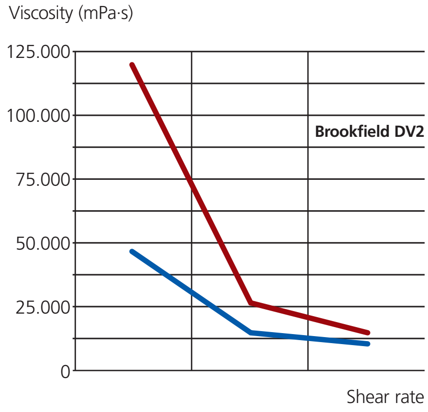


	Brookfield	Haake	Göttfert
Control	18.500	6.540	4.760
DISPERPLAST-1148	13.500	5.790	4.320

Control DISPERPLAST-1148 figure 9

Formulation:
100.0 pts PVC
65.0 pts Plasticizer
70.0 pts $CaCO_3$
20.0 pts TiO_2
4.0 pts Azodicarbonamide
3.0 pts Liquid kicker
6.0 pts VISCOBYK
0.6 pts DISPERPLAST-1148

Viscosity Reduction of a Highly Filled Plastisol (e.g. Carpet Backing)



	2.5 rpm	20 rpm	50 rpm
Control	119.600	26.400	14.840
DISPERPLAST-1148	46.400	14.950	10.580

Control DISPERPLAST-1148 figure 10

Formulation:
100.0 pts PVC
70.0 pts Plasticizer
250.0 pts $CaCO_3$
0.8 pts BYK-2616
3.2 pts Carbon black paste
1.0 pts Stabilizer
2.0 pts DISPERPLAST-1148

Viscosity Reduction of a $CaCO_3$ Paste with DISPERPLAST-1148 in DINP

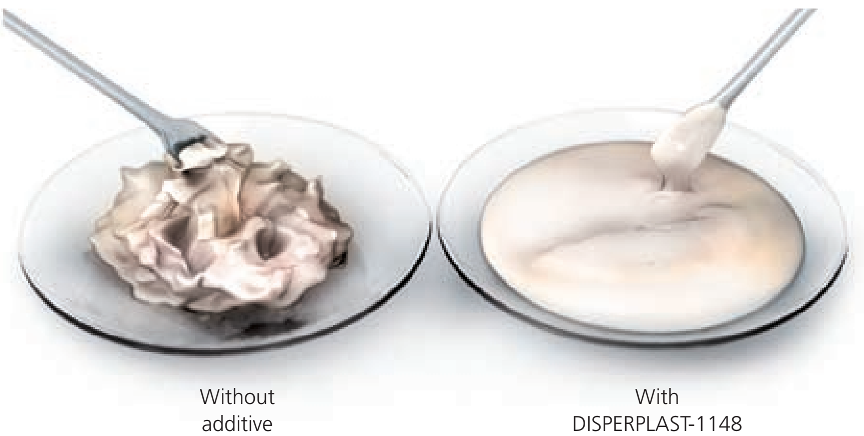


figure 11

Viscosity Reduction of a 35% Basic Carbon Black Paste using BYK-9077

Without wetting and dispersing additive

With wetting and dispersing additive BYK-9077

figure 12

Application Fields

	Inorganic Pigments	Organic Pigments	Inorganic Fillers	Azodicarbon-amide	ZnO	Carbon Black	Co-grind of Pigments
DISPERPLAST-I	■	□		■	■		■
DISPERPLAST-P	□	■				■	□
DISPERPLAST-1142	■	□	■	□	□		
DISPERPLAST-1148	■		■	■	■		□
DISPERPLAST-1150	■	□	■	■	■	□	
BYK-9076	□	■		□		■	
BYK-9077		□				■	

■ Recommended □ Suitable

figure 13

Products and Applications

BYK Additives

Additives are used during the production of coatings, printing inks and plastics to optimize the production process and to improve the quality of the final product.

Product Range Additives
- Additives to improve surface slip, leveling and substrate wetting
- Adhesion promoters
- Defoamers and air release agents
- Foam stabilizers
- Processing additives
- Rheological additives
- UV-absorbers
- Viscosity depressants
- Waxes
- Wetting and dispersing additives for pigments and extenders

Application Areas
- Ambient curing resins (FRP)
- Architectural coatings
- Automotive OEM
- Automotive refinishes
- Can coatings
- Coil coatings
- Color masterbatches
- Industrial coatings
- Leather coatings
- Marine paints
- Molding compounds
- Paper coatings
- Pigment concentrates
- Polyurethane foams
- Powder coatings
- Printing inks
- Protective coatings
- PVC plastisols
- Thermoplastics
- Wood and furniture coatings

BYK-Chemie GmbH
P.O. Box 10 02 45
46462 Wesel
Germany
Tel +49 281 670-0
Fax +49 281 65735

info@byk.com
www.byk.com/additives

BYK Instruments

BYK offers a complete line of testing instruments to meet your needs in many application areas:
- Gloss/Appearance
- Color

Portable or stationary laboratory equipment – including easy to use quality control software.

BYK instruments – the complete solution for the coatings and plastics industry.

BYK-Gardner GmbH
P.O. Box 970
82534 Geretsried
Lausitzer Strasse 8
82538 Geretsried
Germany
Tel +49 8171 3493-0
+49 800 427-3637
Fax +49 8171 3493-140

info.byk.gardner@altana.com
www.byk.com/instruments

BYK
Additives & Instruments

01/2009