

Substance for Success.



Technical Information PVC-TI 4

Rheology Additives

PVC Plastisol Applications

Polarity Influence on the Effectiveness of BYK-410

low polar	optimal	high polar
White spirit	BBP/DIDP (blend) DOP	Water
	BBP	
	DINP	Ethanol
Adipate	DIDP	
	Linear phthalate 711 + 911	
Xylene		Butanol

figure 1

Mechanism of BYK-410

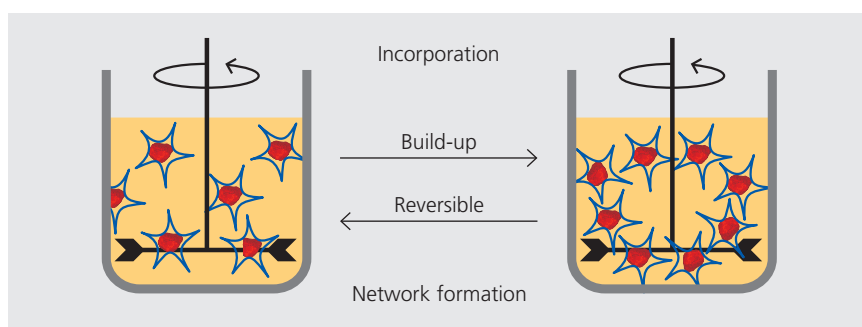


figure 2

Settling of a 30% TiO₂ Plasticizer Paste

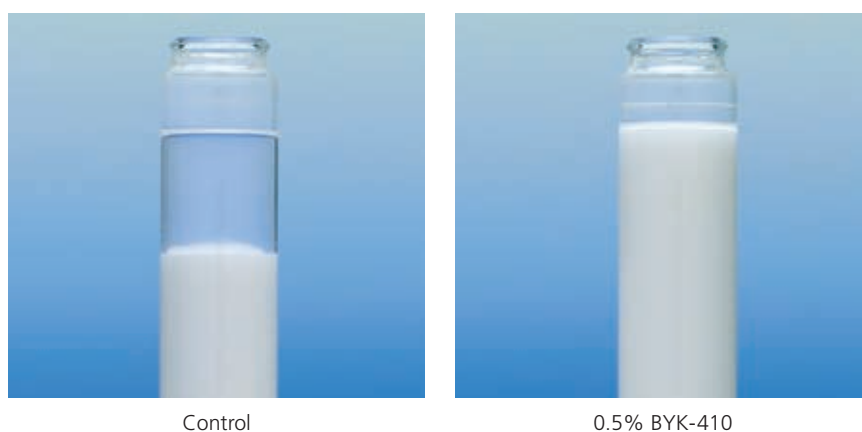


figure 3

Why Rheology Additives?

Flow behavior is one of the most important technical properties of a PVC plastisol. To a great extent, it determines the usability and user-friendliness of the paste. In plastisols, thickeners, such as fumed silica, polysulfonates, bentonite clays and precipitated calcium carbonate have been traditionally used. They may exhibit the following undesirable properties and limitations:

- difficult to store and handle
- hard to disperse properly
- high viscosity at high shear rates, which can lead to coating defects (e.g.: "spitting") during knife coating and spraying
- poor air release due to highly pseudoplastic rheology
- non-reproducible results
- insufficient heat sag resistance
- loss of thickening effect when used with an amine adhesion promoter.

The unique liquid rheological additive BYK-410 is required for optimum adjustment of rheological properties. In many cases, the additive is used to improve the anti-settling properties (figure 3) during storage and to avoid sagging during application.

In addition, it reduces flooding and floating of pigmented PVC plastisols by increasing the yield point.

The rheological behavior of a PVC plastisol using BYK-410 will depend on the following:

1. Polarity and amount of the emulsifiers and surfactants on the PVC resin.
2. Polarity of the plasticizer type and content (figure 1).
3. The type and amount of solids (e.g. filler, pigment etc.).
4. Other ingredients (e.g. stabilizer, additives).

An additional major factor for the rheological behavior, however, is the dependence of viscosity on the shear rate. For many PVC plastisol applications, a relatively larger shear range must be taken into account. A rheological characterization over the entire shear range is best obtained by means of rotational viscometers.

Liquid Rheology Additive BYK-410

How does it work?

BYK-410 consists of a solution of modified ureas in N-methyl-pyrrolidone. When the additive is post-added to the PVC plastisol, it precipitates in a controlled way, forming fine needle-like crystals, which then build up a three dimensional network. This structure is maintained through hydrogen bonds. Because the plastisol becomes thixotropic, this effect is reversible under shearing, thus giving the PVC plastisol the desired low application viscosity (figure 2).

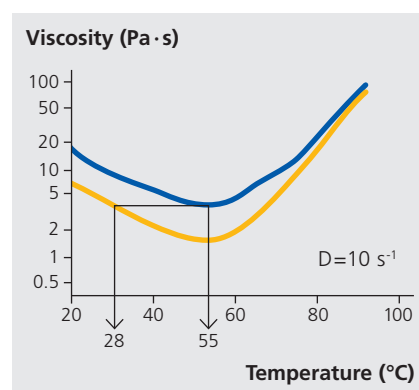
Incorporation:

- The additive should be slowly post-added under continuous agitation.
- Mixing condition can influence the efficiency of BYK-410. The optimum effectiveness is achieved using conventional mixing methods such as dissolvers or mixers. In the lab, the PVC plastisol should be mixed as close to the actual factory conditions as possible (e.g.: temperature, mixing time).
- The effectiveness of the additive is not linear in its effects. Therefore, various levels should be evaluated.
- After addition, a period of up to 2 hours may be required until the initial structure forms and up to 24 hours until it is fully established.
- Pre-mixing with adhesion promoters and stabilizers should be avoided.

Benefits of BYK-410:

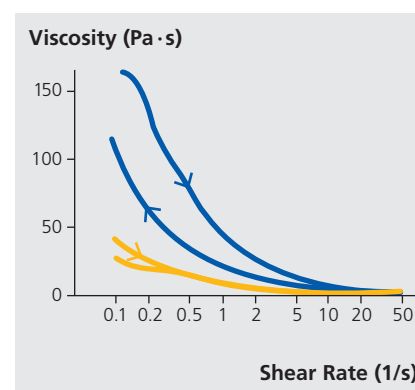
- pourable liquid – easy to handle and use
- high degree of effectiveness
- offers a unique rheology
- controlled coating profile in fusion oven, to include impregnation of open fabrics (figure 4)
- shear thins with light to moderate shear (figure 5)
- higher thix index (figure 6)
- post-addable
- reduced heat sag (figure 7)
- allows for the uniform coating thickness/ profile especially in coating lines where the line tension is excessive causing a wavy substrate (e.g.: release paper)
- prevents filler and pigment sedimentation
- reduction of flooding and floating (figure 8)
- improves adhesion to polyester and polyester/cotton fabrics
- uses less storage space
- no influence on color and gloss

Temperature Influence on PVC Paste



Control BYK-410 figure 4

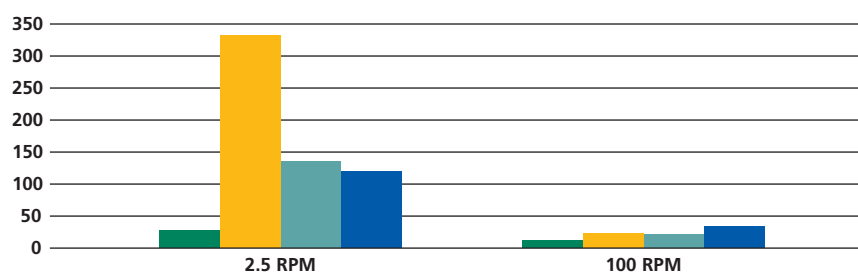
Thixotropy with BYK-410



Control BYK-410 figure 5

Thix Index

Viscosity* (Pa·s)



* Brockfield RVT Viscometer

Control 1.0 phr BYK-410 3.0 phr Polysulfonate 1.5 phr Fumed Silica figure 6

Reduced Heat Sagging

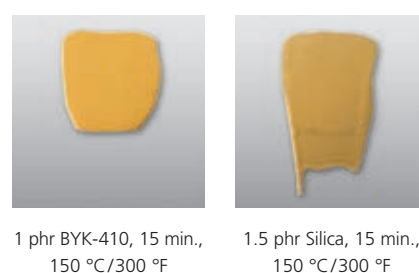


figure 7

Reduction of Flooding and Floating

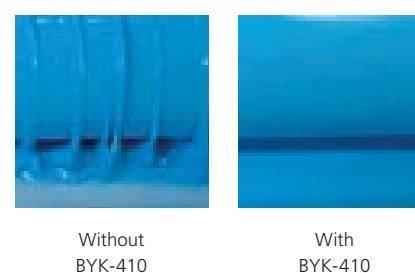


figure 8

Application Fields

	Anti-settling	Sag Control	Viscosity Enhancement	Controlled Impregnation	Reduced Flooding / Floating
BYK-410	■	■	■	■	■

■ Recommended

figure 9

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

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