



Technical Information B-RI 18

OPTIFLO

Water-soluble, Associative Thickener for Aqueous Formulations

OPTIFLO – Products and Applications

The OPTIFLO family of thickeners has been designed to offer formulators broad formulating latitude in paints, coatings, inks, sealants, caulks, and adhesives while alleviating many of the problems often encountered with conventional urethane based thickeners. OPTIFLO products impart excellent flow and leveling, high film build, excellent stability, and unsurpassed resistance to blister, spatter, and syneresis when used with a broad variety of latex binders including large and small particle size acrylics, vinyl acrylics, styrene acrylics, and ethylene vinyl acetates (EVA's). While the use of OPTIFLO thickeners can eliminate or reduce the need for cellulosics, OPTIFLO products are more compatible with cellulosics than urethane based thickeners leading to reduced paint syneresis and curtain sagging.

OPTIFLO HEAT (Hydrophobic Ethoxylated Aminoplast Technology) Polymers

- Non-ionic and emulsifier-free
- Low odor and water clear
- Products to meet all shear ranges
- Creates excellent brush drag
- Reduces spattering
- Does not affect acceptance of tint pastes
- Pseudoplastic/thixotropic behavior to prevent settling

OPTIFLO HEUR (Hydrophobic Ethoxylated Urethane) Polymers

- Non-ionic and emulsifier-free
- Typical HEUR odor and clarity
- Designed for high shear viscosity range for EVA, Vinyl, Acrylic, and low responsive systems
- Suitable for exterior coatings

OPTIFLO HEAT technology in paints and coatings

- Increased resistance (to water, alcohol, liquid cleansers, etc.)
- Improved barrier effect
- Improved viscosity stability with tinting pastes
- Increased stability with respect to pH fluctuations
- No syneresis and improved storage stability
- No reduction in gloss
- Haze-free

Viscous properties

Use OPTIFLO whenever you need effective brush drag. OPTIFLO increases viscosity, which primarily serves to improve spatter resistance. Because OPTIFLO have no yield point, they generate superior leveling characteristics in paints.



OPTIFLO ADDITIVES

	OPTIFLO Standard Products							OPTIFLO Specialty Products
	T1000	L100	L1400	M2600VF	H370VF	H600VF	H7500VF	TVS-VF
Industrial coatings	■	■	■	■	■	□	□	■
Wood coatings	□	□	□	■	■			
Furniture coatings	■	■	■		□	□	□	
UV-curing parquet coatings				□				
Paints for artists	□	□	□	□	■	□	□	□
Latex paints	■	■	■	■	■	■	■	■
Pigment concentrates	□	□	□		□			■
Metallic finishes	■	■	■		□	□	□	
Printing inks	■	■	■					
Latex plasters	□	□	■			■	■	
Coloured sandstone plasters	□	□	□			■	■	
Special Applications								
Adhesives	□	□	□		■	■	■	
Textile auxiliaries						■	■	
Textile dyes	□	□	□					
Window paints	■	■	■	■	□			

■ especially recommended □ recommended

figure 1



Structure of OPTIFLO

OPTIFLO is a water-soluble, associative polymer thickener. OPTIFLO primarily consists of water-soluble polyethylene glycol, onto which a few non-water-soluble (hydrophobic) molecules have been added via a patented aminoplast linkage. In aqueous solution, these hydrophobic molecules either group together to form micelles or associate with other hydrophobic components, such as latex particles.

The long polyethylene oxide backbone remains dissolved in water, where it links micelles and latex particles into a network – this is what raises the viscosity. The more (finely divided) latex particles there are that can associate with the hydrophobic modules, the greater the thickening effect. Hence the term “associative” thickening.

How it works

When the interactions described above form a three-dimensional network, associative thickeners greatly increase viscosity, especially under high-shear conditions. This strengthens the internal structure and thickens the material to a honey-like consistency, a process also described as brush drag. The number and chemical nature of the hydrophobic groups in the thickener molecule determine whether the increase in viscosity that can be achieved will produce Newtonian or thixotropic/pseudoplastic behavior.

Unlike systems utilizing laminar silicates (OPTIGEL) to produce thixotropic behavior, systems thickened with OPTIFLO have no yield point, which ensures superior paint flow and levelling following application.

Associative Thickening Mechanism

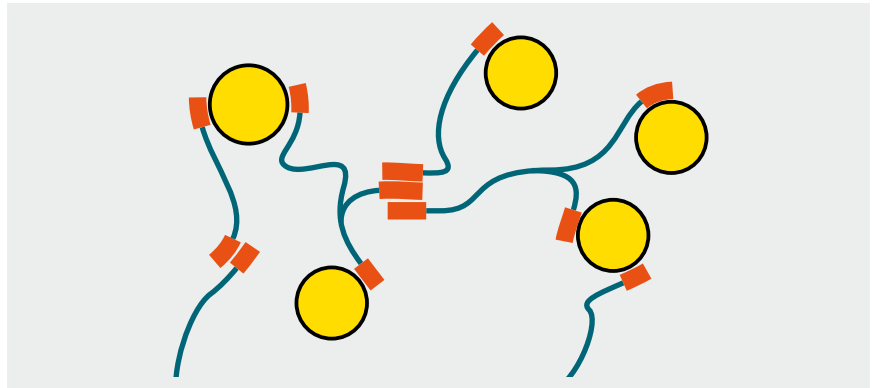


figure 2

Flow Curve

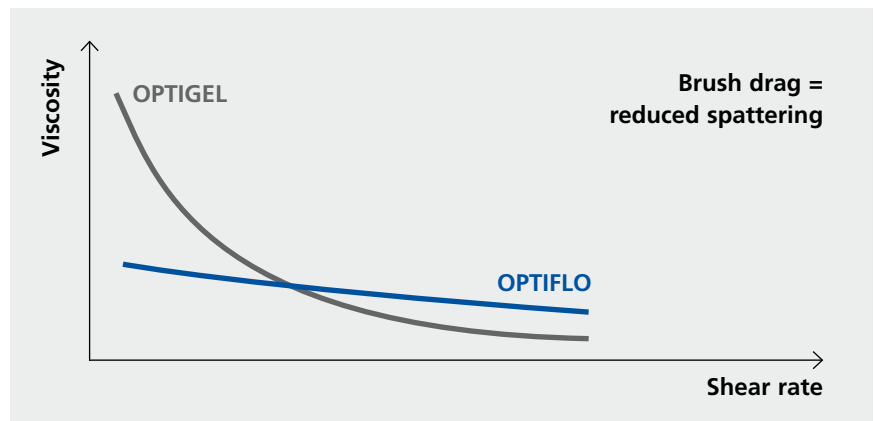


figure 3

OPTIFLO Additives in Decorative Systems

Applying paints using a brush or roller places special demands on the rheology of coating systems, particularly with water-borne paints. This is especially true for decorative applications, where products are applied primarily by brush or roller.

Unlike other methods, such as spraying, pouring or dipping, this type of manual application requires paint to have certain unique rheological properties. The reduction of viscosity under shear needs to be influenced and kept within certain limits. Otherwise, the paint will lack the inner tenacity at high-shear conditions which will result in extremely thin coatings. Consequently, the paint coverage will be either poor or insufficient, potentially requiring numerous coats.

Due to the chemical structure, rheological additives such as laminar silicates have very little affect on this phenomenon. As a result, they are only effective under low-shear conditions, which consequently lend to the paint's thixotropy and/or pseudoplastic properties. The result is a necessity for a different approach to elevate the viscosity at high shear rates (typically in the range of $10,000 \text{ s}^{-1}$).

Associative thickeners designed to achieve brush drag in aqueous mediums have the ability to form bonds (associations) with binder particles, pigments, fillers or even with themselves. The network that results from these links is stable even in high shear conditions, thereby generating effective brush drag.

Forming a homogenous network within the paint and within the paint film after application will quickly make the dried coating water resistant.

OPTIFLO in a satin VAE formulation with 3 % universal colorant showing an elimination of colour float vs a competitive HEUR thickener.

Phthalo Blue



figure 4

Red Iron Oxide



figure 5

Lamp Black



figure 6

OPTIFLO ADDITIVES for Tinting Paste Systems

Associative thickeners are often sensitive to the addition of surfactants, dispersing agents, wetting agents, and solvents. These additives reduce the associative interactions between the latex particles and the hydrophobic modules of the thickener, thereby reducing viscosity. This problem primarily arises when adding pigment concentrates which contain large amounts of interfering agents, such as dispersants and surfactants. Our OPTIFLO TVS (Tinting Viscosity Stabilizer) thickener has been specially designed to address this issue. Due to the unique opportunities afforded by aminoplast technology, OPTIFLO TVS contains an unusually high number of strongly hydrophobic modules, making it less sensitive to these interferents. OPTIFLO TVS is especially suitable for base paints tinted with pigment concentrates.

Conclusions

Over the years the Paint and Coatings Industry has adopted environmental regulations to lower VOC (Volatile Organic Content) emissions in architectural coatings. As a result, paint manufacturers are moving from traditional oil-based paint systems to water-borne paint systems. The challenge for the paint manufacturer is to maintain performance properties such as brushability, stain removal and durability.

The OPTIFLO thickener system introduced in 1997 was designed for the paint manufacturer for use in latex or water-borne paints to provide a smooth creamy paint consistency with buttery like brush feel while preventing roller spatter (splashing that can occur from the paint roller). In addition, a novel patented technology was recently developed which will allow all OPTIFLO products to be supplied VOC free, this technology known as OPTIFLO VF Technology, will also further enhance the quality of the paint in areas such as color uniformity and paint consistency (less separation).

Reduction in Viscosity when Surfactants are Added 10 Systems Using a Standard Thickener

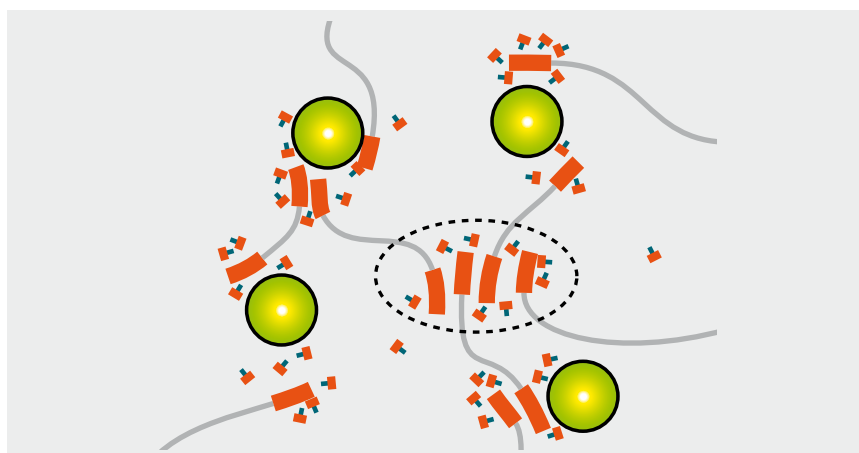
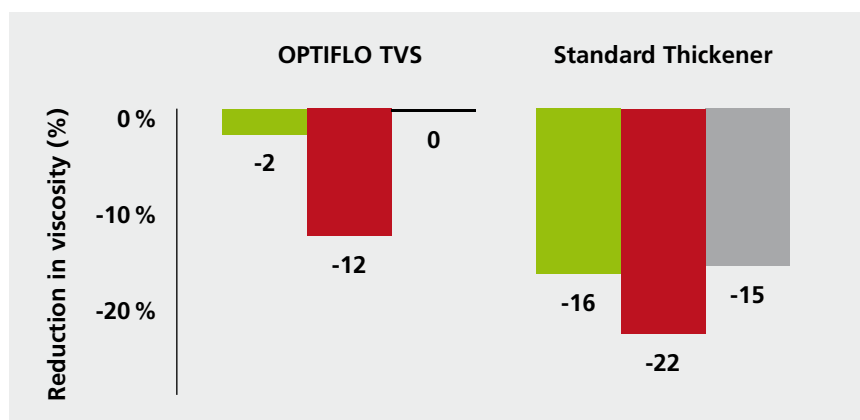


figure 7

OPTIFLO TVS in a Semi-gloss Latex Paint



Very little loss in viscosity is observed when tinting with an universal pigment paste (phthalocyanine green, iron oxide red, lamp gray).

figure 8

OPTIFLO Product Overview

OPTIFLO Additives in Formulations

Three basic types of OPTIFLO products are available: OPTIFLO T, L, M and H

- The thickening behavior of OPTIFLO L products is largely Newtonian
- The thickening behavior of OPTIFLO M products is slightly pseudoplastic
- OPTIFLO H products, on the other hand, are very pseudoplastic
- Regardless of grade, all OPTIFLO products have excellent thickening properties, particularly at high shear rates

Flow Curve

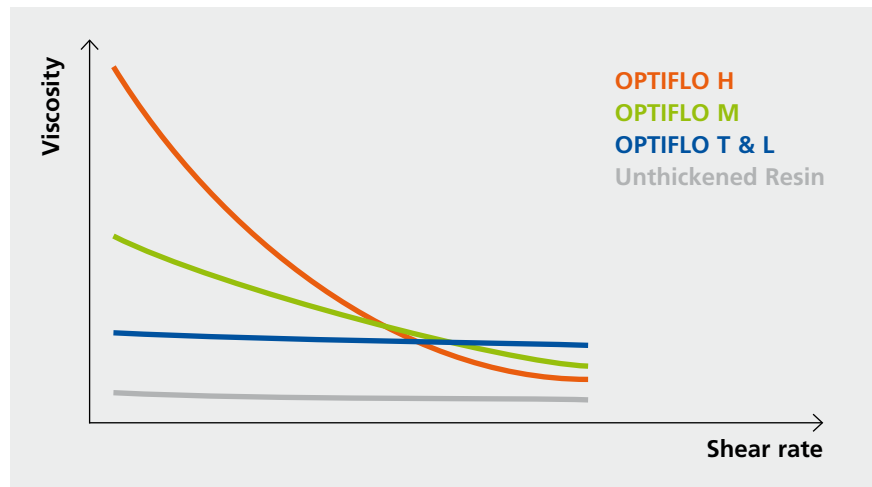


figure 9

OPTIFLO	Chemistry	Actives (%)	Ratio (P:N ¹)	VOC free	Typical Usage ² (%)	Description/Comments	Acrylic	Sty-Acr	Vinyl Acr	VAE/EVA
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High & Mid Shear Rheology Modifiers

T1000	HEUR	22.5	1:5	✓	0.8–2.0	ICI Driver with minimal impact on ku response	■	■	■	■
L100	HEAT	20.0	2:4	✓	1.0–3.5	ICI builder best suited for acrylic & styrene-acrylic systems. Provides excellent syneresis resistance	■	■	□	
L1400	HEUR	20.0	2:4.5	✓	0.8–2.0	Highly efficient ICI builder suited for acrylic, styrene-acrylic systems	■	■	□	
M2600VF	HEUR	20.0	3:3	✓	0.5–2.5	Designed for lower response resin systems and offers “Balanced Rheology” in these systems	■	■	■	■

Low Shear Rheology Modifiers

H370VF	HEAT	17.5	4.5:2	✓	0.5–2.5	VF & easier incorporating version of H370 also offers improved color acceptance	■	■	□	□
H600VF	HEAT	15.0	4.5:1	✓	0.5–2.5	VF & easier incorporating version of H600 supplied at lower actives	■	■	□	
H7500VF	HEUR	17.5	5:1	✓	0.25–1.0	cPs/KU Driver for low binder systems, ideal for spray applied contractor brands		□	■	■

Specialty Rheology Modifiers

TVS-VF	HEAT	12.5	Water	✓	0.5–1.5	VF & easier incorporating version of TVS supplied at lower active content	■	■	■	■
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■ especially recommended □ recommended

figure 10

¹ P = pseudoplastic; N = newtonian; 1 = weak, 5 = strong,

² Typical use levels as delivered. Actual usage is dependent on binder type, level, and desired rheological properties

Products and Applications

BYK Additives

Product Range Additives:

- Additives to improve surface slip, leveling, and substrate wetting
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- Rheological additives
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- Viscosity depressants
- Wax additives
- Wetting and dispersing additives for pigments and extenders

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