

# Borchers Rheological Additives

for waterborne coating systems

Borchi<sup>®</sup> Gel

Additives with a thickening effect have a significant influence on the shelf life and application properties of liquid coating systems and have always been an important component in the formulation of coatings. Even during coating production, they improve the introduction of energy into the mill base and thus optimize dispersibility (Fig. 1). At the same time, rheological additives improve shelf life by reducing the tendency settling and separation of the coating formulation. Without adequate rheological control, these systems very often show syneresis effects (Fig. 2).



Fig.1: Mill base for a coating



Fig. 2: Syneresis in an emulsion coating

In the industrial application of such systems, rheological additives ensure optimal flow and leveling properties combined with minimum sagging tendency. Inappropriate rheological control might be the reason for building so-called curtains or runners that will strongly impact the quality of the resulting film (Figs. 3a/3b).

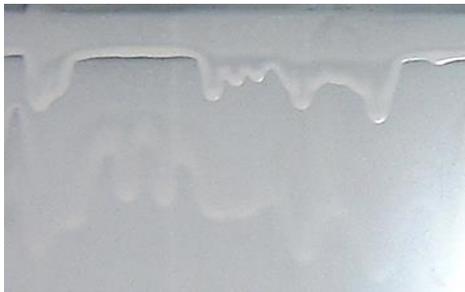


Fig. 3a: Spraying varnish for industrial coatings showing 'curtains'



Fig. 3b: Waterborne emulsion coating with 'runners'

Without suitable thickeners introducing a sufficient coherence despite the high mechanical stresses (so-called high shear thickeners), coating particles are very easily flung away from the brush or roller due to centrifugal forces. This significantly increases the spattering tendency (Fig. 4a) of the coating. The viscosity setting of a liquid phase affected by high shear forces plays a decisive part in film formation, hiding power, spattering (see above), brush and roll resistance. When brushing or rolling, for example, good results can only be achieved if the viscosity of the applied coating remains high even at a high shear rate (brush drag). If the brush drag is inadequate, a considerable proportion of the coating material applied to the surface is pushed along in front of the brush or roller without sticking to the substrate (Fig. 4b). This results in poor coverage, uneven application and poor leveling. The phenomenon of edge marks (Fig. 4c) and wetting defects may also be due to inappropriate rheology of the applied system.



Fig. 4a: Roller-coated coating without adequate high shear thickener

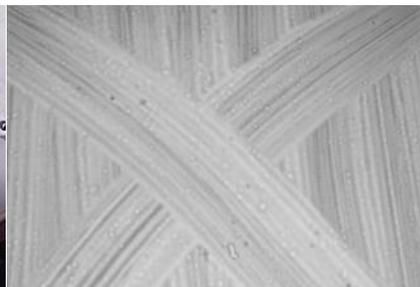


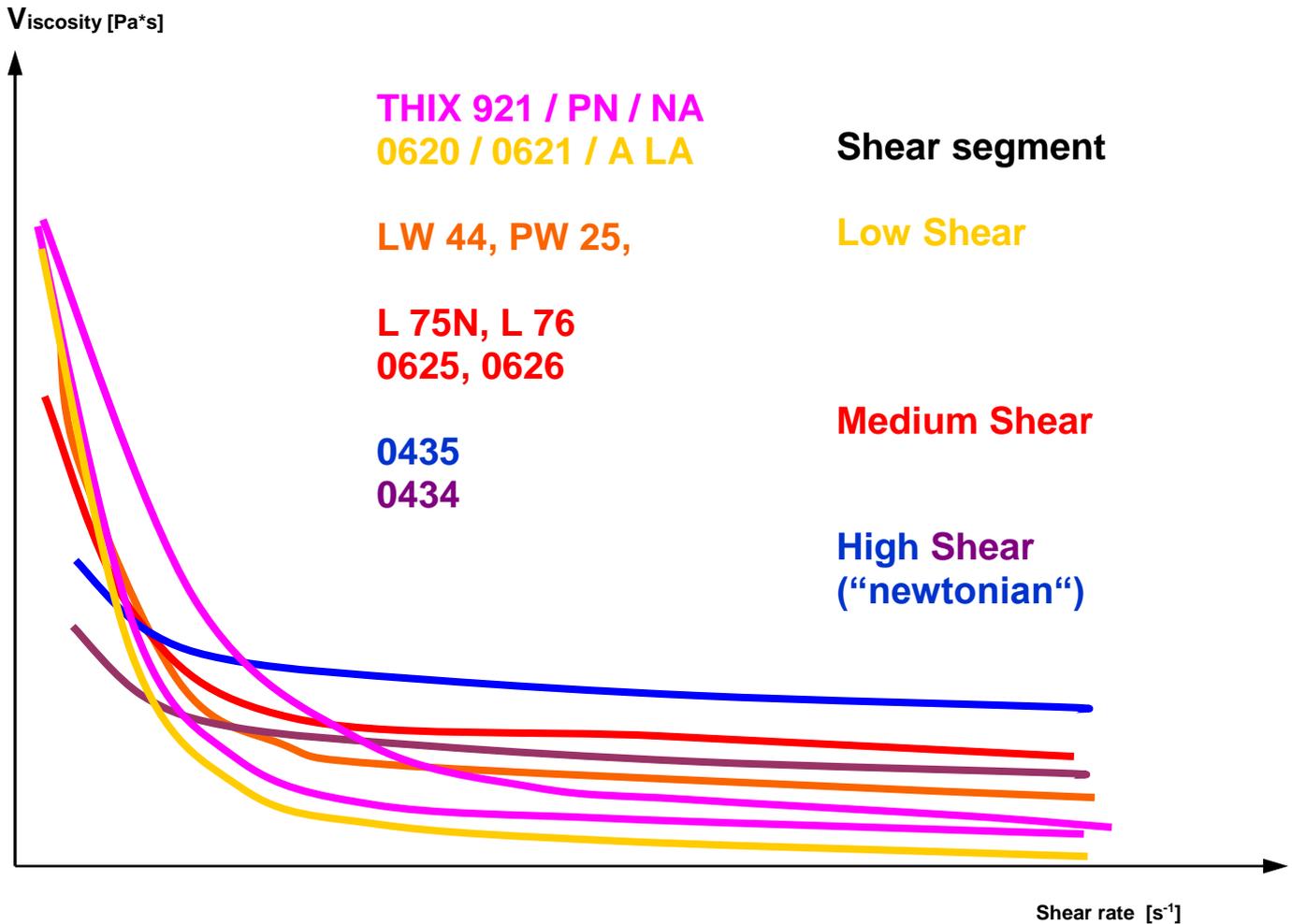
Fig. 4b: Brush-applied emulsion coating with inadequate brush drag



Fig. 4c: Inadequate edge coverage with a white coating on a metal substrate

Inadequate rheological control in the production of coatings can lead to a significant reduction in quality. Especially when changing over from solvent-based formulations to waterborne alternatives, the selection of a suitable rheological additive is essential. Apart from cellulose and acrylic thickeners – to mention only the most common pseudoplastic thickeners for waterborne systems – associative thickeners also play an important part. In terms of their structure, associative thickeners are polymer compounds with hydrophilic and hydrophobic segments, which, because of their segmented structure, are able to form fairly stable associates with each other and/or with the other components of the coating formulation (binder, pigment, filler particles etc.). By modifying the chemical structure, it is basically possible to vary the stability of the associates and thus the rheological properties of a coating system.

The most important associative thickeners are produced on a polyurethane basis. Unlike cellulose or polyacrylic thickeners, these polyurethane thickeners affect neither the water sensitivity nor the light fastness of a formulation and, depending on the type, provide pseudoplastic or newtonian flow properties. The large number of commercially available binders with different properties does, however, make it difficult to select the most suitable polyurethane thickener. It is therefore important to have a sufficiently wide range of suitable products available, with the aid of which any desired rheological profile can be achieved, either individually or in combination. It is a question of carefully considering which rheological additives are suitable in what quantity for the particular application without adversely affecting other properties.



Modern waterborne coating systems are formulated as "low-VOC" or "VOC-free" (VOC = volatile organic compound), which means that the rheological additives must comply with the strict, modern-day requirements on environmental compatibility. In addition to the already known problems with VOCs, there has been much debate for some time now on the usability of some glycol derivatives (e.g. ethylene glycol, butyl glycol) and certain emulsifier types (e.g. APEOs = alkylphenol ethoxylates). In the USA, for example, a large number of glycol ethers are regarded as HAPs (Hazardous Air Pollutants), which are known or suspected to cause serious health damage. Their use is restricted by thresholds under the "Clean Air Act" (in the revised version of 1990).

This kind of critical substances should be avoided in today's polyurethane thickeners without compromising the products' technical properties. The latest generation of associative thickeners from Borchers meets these requirements, containing no VOCs, HAPs, APEOs, glycols and organic tin compounds. These products allow the specific modification of the rheology of a coating system so that it can be tailored to the particular application conditions. Product properties such as vertical flow, leveling, gloss, film thickness, covering power, spattering tendency, brush and roll resistance, sedimentation tendency and pigment stabilization can be specifically optimized. In most cases, only small quantities of between 0.1 and 0.4 % thickener, calculated on the overall formulation, are sufficient. In addition, such additives also have an influence on the properties of the coating after its application, for example on adhesion and elasticity and on the resistance to soiling, abrasion, water and corrosion. With a modular associative thickener system from Borchers, rheology problems have become a subject of the past.

## Products at a glance

The **Borchi® Gel** product group comprises polyurethane based thickeners which work associatively through the formation of a non-covalent network and non-associative thickeners as well. Therefore the natural paint characteristics (e.g. stability) will be improved as well as application properties (e.g. leveling, anti-sag, hiding power, spatter resistance). Depending on their efficacy in the referring shear segment, the products can be divided into groups of low shear (Brookfield), mid shear (KU) and high shear (ICI) thickeners.

Product	Distinguishing properties
<b>Borchi® Gel 0620</b>	<b>Shear thinning</b> HEUR thickener for the viscosity adjustment in the low shear segment; particular suitable for industrial and decorative varnishes which are applied via spray gun or dip application; together with a Newtonian thickener it's suitable for brush and roll application, too.
<b>Borchi® Gel 0621</b>	<b>Shear thinning</b> HEUR thickener; VOC free for the viscosity adjustment in the low shear segment; particular suitable for industrial and decorative varnishes which are applied via spray gun or dip application; together with a Newtonian thickener it's suitable for brush and roll application, too.
<b>Borchi® Gel THIX 921</b>	<b>Shear thinning</b> HEUR thickener; thixotropic behaviour in many binders, highly efficient in low shear range, preventing settling of pigments and sagging; ideal flow behaviour for spray application; in a blend with newtonian thickener also suitable for brush and roll application
<b>Borchi® Gel A LA</b>	<b>Shear thinning</b> , non associative ASE thickener, highly efficient at pH > 8, 10% in water.
<b>Borchi® Gel PN</b> <b>Borchi® Gel NA</b>	<b>Shear thinning</b> thickener; thixotropic behaviour in many binder systems; highly efficient in low shear range, preventing sagging and settling; may be added stand alone or in combination with Newtonian thickeners. <b>Borchi® Gel PN: organic Zirconium complex; neutralized with ammonia</b> <b>Borchi® Gel NA: organic Zirconium complex; neutralized with sodium hydroxide; low odor</b>
<b>Borchi® Gel PW 25</b>	<b>Shear thinning</b> HEUR thickener; 25% PU in water/propylene glycol; emulsifier-free and DBTL-free; especially effective in the low shear range.
<b>Borchi® Gel LW 44</b>	<b>Shear thinning</b> HEUR thickener; 24% PU; 46% solids; especially effective in the low shear range; promotes pigment wetting; DBTL-free and VOC-free.
<b>Borchi® Gel 0625</b>	<b>Universal</b> HEUR thickener with well-balanced efficiency in medium and high shear range; 25% PU; 34% solids; APEO-free, HAP's-free, VOC-free and tin-free; for universal application
<b>Borchi® Gel L 75 N</b>	<b>Universal</b> HEUR thickener with well-balanced efficiency even in medium and high shear range; 25% PU; 50% solids; for universal application; promotes pigment wetting and pigment stabilization, DBTL-free and VOC-free
<b>Borchi® Gel L 76</b>	<b>Universal</b> HEUR thickener for all kind of waterborne systems; high compatibility and efficacy in the low and mid shear (KU) segment; good price-performance ratio; provides good leveling in latex paints, DBTL-free and VOC-free
<b>Borchi® Gel 0626</b>	<b>Universal</b> HEUR thickener with good efficiency in high shear range; 25% PU; 37% solids; APEO-free, HAP's-free, VOC-free and tin-free; for universal applications
<b>Borchi® Gel 0434</b>	<b>Strong newtonian</b> high shear thickener (HEUR); universal use; improves paint stability; displays strong hue by tinting with pigment concentrates; fulfils highest environmental demands.
<b>Borchi® Gel 1430</b>	<b>Strong newtonian</b> high shear thickener (HEUR); universal use; good color acceptance; improves spatter resistance; paint stability and hiding power. Solvent-free; HAP's-free, surfactant-free and tin-free
<b>Borchi® Gel 0435</b>	<b>Newtonian</b> high shear thickener (HEUR) for all kind of waterborne coatings, clear or pigmented; especially suitable in high gloss resin binders with small particle size as well as in waterborne decorative paints, high compatibility with most resin binders, extremely economical.

	Characteristic						Field of Application				
	Active-substance [%]	Catalyst	Stabilizer	Rheological Profile	VOC-free according to 1999/13/EC	VOC-free according to 2004/42/EC	Architectural	Decorative	Industrial	UV-Systems	Adhesives
Borchi® Gel 0620	appr. 40	Tin-free	APE-free	Shear thinning	-	-	+	++	++	++	+
Borchi® Gel 0621	appr. 20	Tin-free	APE-free	Shear thinning	+	+	+	++	++	++	+
Borchi® Gel THIX 921	appr. 25	Tin-free	APE-free	Shear thinning thixotropic	-	-	++	++	++	+	+
Borchi® Gel A LA	appr. 10	Tin-free	APE-free	Shear thinning	-	-	+	+	++	+	++
Borchi® Gel PN / NA	appr. 10	Tin-free	APE-free	Shear thinning thixotropic	+	+	++	++	+	+	+
Borchi® Gel PW 25	appr. 25	DBTL-free	APE-free	Shear thinning	-	-	+	++	++	++	+
Borchi® Gel LW 44	appr. 25	DBTL-free	APE-free	Shear thinning	+	+	+	++	++	++	+
Borchi® Gel 0625	appr. 25	Tin-free	APE-free	Universal	+	+	++	++	+	+	++
Borchi® Gel L 75 N	appr. 25	DBTL-free	APE-free	Universal	+	+	++	++	+	+	++
Borchi® Gel L 76	appr. 25	DBTL-free	APE-free	Universal	+	+	++	+	+	+	++
Borchi® Gel 0626	appr. 25	Tin-free	APE-free	Universal	+	+	++	++	+	+	++
Borchi® Gel 0434	appr. 20	Tin-free	APE-free	Strong Newtonian	+	+	++	+	+	++	++
Borchi® Gel 1430	appr. 20	Tin-free	APE-free	Strong Newtonian	+	+	++	+	+	++	++
Borchi® Gel 0435	appr. 30	Tin-free	APE-free	Newtonian	+	-	+	++	++	+	+

++ particularly suitable

+ possible field of application

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## April 2017

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