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RHEOLOGY ADDITIVES
LUVOTIX®
LUVOGEL®
WOLLATROP®

**RHEOLOGY ADDITIVES FOR SOLVENT-BASED,
SOLVENT-FREE & WATER-BASED SYSTEMS**

ENG/EU

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Introduction

Why are rheology additives used?

By adding rheological additives, the flow and deformation properties of lacquers, paints, and other coating materials can be specifically adjusted.

Depending on whether the coating is applied in an automated process or manually by brush, roller or trowel, different rheological properties of the products are required. Immediately after application, the run-off behavior and good flow on the coated surface should be balanced. At the same time, the stability of the formulations during storage and transportation must be ensured.

Rheological properties of paints, varnishes, and other coating materials

Properties such as viscosity and viscoelastic behaviour can be determined with the help of suitable instruments in quality control, and research and development. Flow and viscosity curves are determined from rotary tests, which describe the dependence of viscosity on shear rate.

Oscillatory tests are used to obtain further information on viscoelastic properties such as storage modulus G' and loss modulus G'' . These tests are particularly preferred when, as in the case of adhesives and sealants, rather pasty and semi-solid materials are involved whose structures have higher strength and elastic components.



Figure 1: Ideal viscous (Newtonian) flow behaviour

Very few liquids and basic formulations exhibit ideal viscous flow profile (Newtonian flow behaviour), in which the viscosity depends only on the temperature yet not on the shear rate.

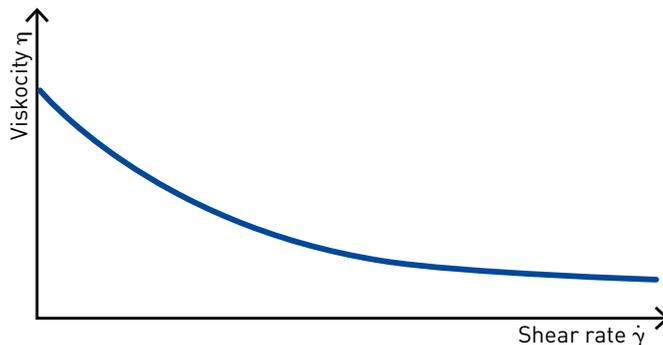


Figure 2: Shear-thinning flow behaviour

Coatings are complex dispersions composed of binders and solvents as well as pigments, fillers, and numerous additives. All ingredients influence the rheological behaviour of the formulation. Very often, a decrease in viscosity with increasing shear rate is observed in these systems due to the orientation of polymer molecules, particles or emulsion droplets in the direction of the shear gradient. This shear-thinning flow behaviour, which is controlled by suitable rheological additives, is also called pseudoplastic.

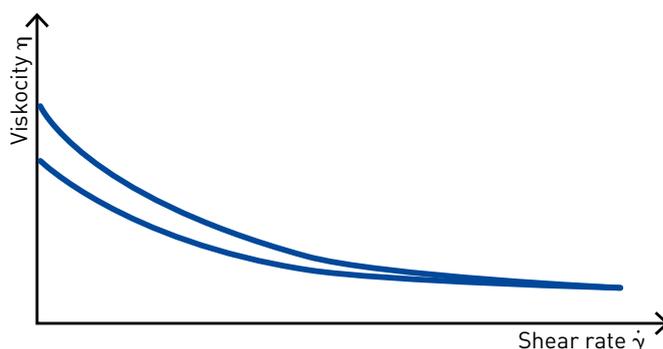


Figure 3: Thixotropic flow behaviour

In addition to the shear-thinning flow behaviour, thixotropic properties can occur in many formulations. The viscosity and the relationship between viscous and elastic material properties then depend both on the level of the shear rate and on the time during which the shear forces act on the material. In the resting state, three-dimensional network structures are present in the material, which are destroyed during shear and which regenerate in a time-dependent manner.

The adjustment of thixotropic properties is relevant in practice for the easy processing of coatings and the control of the flow and run-off behaviour after application. The so-called yield point for pasty and semi-solid products also has a practical significance for the processing procedures, filling, transportation, and storage stability.

A sufficiently high viscosity in the low shear range contributes to improved storage stability of the formulations, preventing particle settling or floating.

In addition, viscosity influences the balance between required run-off resistance and desired uniform flow on the surface.

Coatings are processed at medium and high shear rates, therefore the flow profiles and viscosity are optimally adjusted at a certain shear rate with regard to the coating technique. Table 1 gives an overview of the relevant shear rates for selected coating processes, properties immediately after application, and long-term storage stability.

Table 1: Relevant shear rates for coating materials

	Shear rate	Process
Properties during storage and transport	<0,001-0,01 s ⁻¹	Sedimentation of particles Emulsion creaming
Properties directly after processing	0,01 - 1 s ⁻¹	Sagging Running off Dripping
Properties during processing	1-100 s ⁻¹	Extrusion, dip coating
	10-10 000 s ⁻¹	Mixing, stirring, pumping
	100-10 000 s ⁻¹	Brushes, rollers
	1000 - 10 000 s ⁻¹	Spraying
	> 10 000 s ⁻¹	High-speed coating processes

Organic rheology additives for solvent-based and solvent-free systems

LUVOTIX® rheology additives are fine, micronized waxes that are mostly made from renewable raw materials. The powders are based on castor oil derivatives, fatty acid amides and/or polyolefins. Depending on the polarity of the formulation, the additives are incorporated directly in powdered form in a time- and temperature-controlled dispersion process. In addition to the standard types that have been tested and proven for many years, rheology additives that are particularly easy to activate are also available. The latter develop their full effectiveness after dispersion under shear even at lower temperatures.

Powders

Product	Description	Application
LUVOTIX® R	Castor oil derivate	LUVOTIX® R controls the rheology of low- to medium-polarity liquid organic systems. It is used as a thickener, thixotropic or anti-settling agent in paints and coatings, adhesives, sealants, and putties as well as in oils. LUVOTIX® R is used as a flow and levelling agent in powder coatings.
LUVOTIX® R-RF	Castor oil derivate, inorganically-modified	LUVOTIX® R-RF is used as a thickener and thixotropic agent in low- to medium-polarity liquid organic systems. It is easily dispersible, improves workability, and was primarily developed for putties.
LUVOTIX® ZR50	Castor oil derivate, inorganically-modified	LUVOTIX® ZR50 controls the rheology of low-polarity solvent-based and solvent-free formulations, specifically in highly filled coatings, putties, and sealants.
LUVOTIX® HT	Castor oil derivate, polyamide-modified	LUVOTIX® HT controls the rheology of low- to medium-polarity liquid organic systems. It is used as a thickener, thixotropic or anti-settling agent in paints and coatings, adhesives, sealants and putties as well as in oils. LUVOTIX® HT serves as a flow and leveling agent in powder coatings.
LUVOTIX® HT-SF	Castor oil derivate, polyamide-modified	LUVOTIX® HT-SF is a version of LUVOTIX® HT with easier activation.
LUVOTIX® ZH5	Castor oil derivative, polyamide- and inorganically-modified	LUVOTIX® ZH 5 controls the rheology properties of medium- to high-polarity solvent-based formulations. LUVOTIX® ZH 5 is a free-flowing powder, dispersible and particularly suitable for highly filled systems.
LUVOTIX® ZH50	Castor oil derivative, polyamide- and inorganically-modified	LUVOTIX® ZH 50 controls the rheology of medium- to high-polarity liquid. organic systems, specifically in highly filled formulations.
LUVOTIX® HP	Polyamide	LUVOTIX® HP is used in solvent-based and solvent-free medium- to high-polarity liquid. organic systems. It is suitable as a thickener, thixotropic or anti-settling agent in paints and coatings, adhesives, sealants, putties, and other formulations.
LUVOTIX® AB	Blend of polyamides	LUVOTIX® AB is used in solvent-based and solvent-free medium-polarity liquid organic systems. Its optimum performance is achieved at process temperatures between 50 and 65°C. LUVOTIX® AB is suitable for highly filled and high-gloss systems. It is used in paints and coatings, adhesives as well as in sealants, putties, and other formulations.
LUVOTIX® SAB	Blend of polyamides	LUVOTIX® SAB is suitable as a rheology additive for many applications in solvent-based and solvent-free formulations. Its optimum performance is achieved at process temperatures in the range of 50-70°C, depending on the polarity of the formulation. LUVOTIX® SAB optimizes the sag-control and anti-settling properties and is particularly recommended for high-gloss acrylic- or polyester-based systems.
LUVOTIX® PAB	Blend of polyamides	LUVOTIX® PAB is used as a rheology additive in solvent-based and solvent-free medium- to high-polarity organic systems. Its optimum performance is achieved at process temperatures above 55°C. LUVOTIX® PAB can be used in primers as well as in high-gloss topcoats. It is suitable for industrial coatings, anticorrosive coatings, adhesives, putties and sealants.
LUVOTIX® P100-15	Polyolefin	LUVOTIX® P100-15 is used to modify the flow behavior in medium- to high-polarity solvent-based and solvent-free formulations, especially as an efficient anti-settling agent.

Organic rheology additives for solvent-based and solvent-free systems

Easy activation powders

Product	Description	Application
LUVOTIX® VP031	Polyolefin/Stearic acid derivative-hybrid	LUVOTIX® VP031 is used in solvent-based and solvent-free high-build coatings, adhesives, and sealants. LUVOTIX® VP031 is particularly easy to incorporate and activate (as low as 35 °C) because of its physicochemical properties.
LUVOTIX® LT1	Blend of polyamides	LUVOTIX® LT1 can be activated at very low process temperatures, starting at 40°C. It is used in paints and coatings, adhesives and sealants, putties, and other formulations.

TWOK-Thix

Product	Description	Application
LUVOTIX® TK1	2K rheology additive	LUVOTIX® TK1 is used in situ in combination with crosslinker LUVOTIX® CL1. It is suitable for all systems independent of polarity. In topcoats, it is characterized by high gloss and transparency combined with excellent anti-sag properties.
LUVOTIX® CL1	Amino-functional crosslinker	LUVOTIX® CL1 is used as a crosslinker combined in situ with LUVOTIX® TK1 in a mixing ratio 30:100.

Pastes

Product	Description	Application
LUVOTIX® P25X	Polyolefin paste, 25 % in Xylene	LUVOTIX® P25X is used as an anti-settling and sag-control agent in solvent-based formulations. It improves stabilization in zinc-rich primers.

Additional pastes in other solvents or plasticizers are available upon request.

Additives for powder coatings

Product	Description	Application
LUVOTIX® R400	Castor oil derivate	LUVOTIX® R400 is used in powder coatings as process additive and flow modifier.
LUVOTIX® HT400	Castor oil derivate, polyamide modified	LUVOTIX® HT400 is used in powder coatings as process additive and flow modifier.

Organic rheology additives for solvent-based and solvent-free systems

Organic rheology additives are activated in a time- and temperature-dependent high-shear dispersion process. We recommend the following process temperatures depending on solvent polarity.

	Product	Description	Solvent-based and high-solid systems			Solvent-free systems
			Low polarity	Medium polarity	High polarity	
Powder	LUVOTIX® R	Castor oil derivative	35–55 °C	30–40 °C	–	> 40 °C
	LUVOTIX® R-RF		35–55 °C	30–40 °C	–	> 40 °C
	LUVOTIX® ZR50		35–55 °C	30–40 °C	–	> 40 °C
	LUVOTIX® HT	Polyamide-modified castor oil derivative	50–70 °C	35–55 °C	–	50–75 °C
	LUVOTIX® HT-SF		50–70 °C	35–55 °C	–	50–75 °C
	LUVOTIX® ZH5		50–70 °C	35–55 °C	–	50–75 °C
	LUVOTIX® ZH50		50–70 °C	35–55 °C	–	50–75 °C
	LUVOTIX® HP	Polyamide	–	55–65 °C	50–65 °C	50–65 °C
	LUVOTIX® AB		–	50–65 °C	45–60 °C	45–65 °C
	LUVOTIX® SAB		–	50–70 °C	45–65 °C	40–70 °C
	LUVOTIX® PAB		–	50–75 °C	45–70 °C	40–75 °C
	LUVOTIX® LT1		40–90 °C	40–75 °C	40–60 °C	40–90 °C
	LUVOTIX® P100-15		Polyolefin	–	45–65 °C	40–60 °C
	LUVOTIX® VP031	Polyolefin hybrid	35–65 °C	35–55 °C	–	35–75 °C
Paste	LUVOTIX® P25X	Polyolefin paste	> 45 °C	> 45 °C	> 45 °C	–
2K additive	LUVOTIX® TK1/CL1	Liquid 2-pack-rheology additive	suitable for all ranges of polarity does not require a particular process temperature for activation			

Organic rheology additives for water-based systems

LUVOTIX® ATAC are synthetic associative thickeners for water-based formulations, which are supplied as low-viscous acrylic emulsions. The anionic polymers develop viscosity after neutralization in the pH-range from 7.0 to 10.0.

Different shear-thinning rheological profiles can be achieved depending on the hydrophobic modifications of the molecules.

LUVOTIX® ATAC

Product	Description	Application
LUVOTIX® ATAC L 100	Hydrophobically-modified associative thickener based on HASE	LUVOTIX® ATAC L 100 is a hydrophobically-modified associative thickener used in waterborne adhesives, sealants, paints and coatings to improve both storage stability and sag resistance and settling behavior. LUVOTIX® ATAC L 100 produces a highly pseudoplastic flow profile in waterborne formulations and is particularly recommended to increase viscosity in the low to medium shear range.
LUVOTIX® ATAC M 400	Non-associative thickener, based on ASE	LUVOTIX® ATAC M 400 is a VOC-free non-associative thickener for waterborne formulations and is used in paints, coatings as well as sealants and adhesives to improve color acceptance and wet abrasion. LUVOTIX® ATAC M 400 produces a pseudoplastic flow profile in waterborne formulations and is particularly recommended to increase the viscosity in all shear ranges.
LUVOTIX® ATAC H 700	Hydrophobically-modified associative thickener based on HASE	LUVOTIX® ATAC H 700 is a hydrophobically-modified anionic thickener for waterborne adhesives, sealants, paints, lacquers, and protective coatings. Use of LUVOTIX® ATAC H 700 improves the storage stability, levelling, and anti-splash system properties. LUVOTIX® ATAC H 700 produces a newtonian flow profile in waterborne formulations and is particularly recommended to increase the viscosity in the high shear range.

LUVOTIX® ATUR are non-ionic hydrophobically modified polyurethanes used in water-based formulations, independent of pH-range. By tailored modifications of molecular structures, any desired rheological profile from newtonian to strong shear thinning can be obtained. LUVOTIX® ATUR are specifically designed for glossy, high-quality coatings when excellent surface levelling properties are desired after application.

LUVOTIX® ATUR

Product	Description	Application
LUVOTIX® ATUR L 200	Hydrophobically-modified polyurethane thickener based on HEUR	LUVOTIX® ATUR L 200 is a hydrophobically-modified biobased polyurethane thickener. LUVOTIX® ATUR L 200 is used in waterborne adhesives, sealants, and paints and coatings and improves the rub-out resistance, storage stability and chemical/water resistance. LUVOTIX® ATUR L 200 is APEO- and VOC- free and is particularly recommended to increase viscosity in the low shear range.
LUVOTIX® ATUR M 500	Hydrophobically-modified polyurethane thickener based on HEUR	LUVOTIX® ATUR M 500 is a hydrophobically modified polyurethane thickener for waterborne adhesives, sealants, paints, lacquers and protective coatings that improves the levelling, spraying and sag resistance of waterborne formulations. LUVOTIX® ATUR M 500 has a pseudoplastic flow behavior and is particularly recommended for increasing viscosity in the medium shear rate range.
LUVOTIX® ATUR M 510	Hydrophobically-modified polyurethane thickener based on HEUR	LUVOTIX® ATUR M 510 is a hydrophobically-modified polyurethane thickener for waterborne adhesives, sealants, paints, lacquers, and protective coatings that improves levelling, spraying and sag resistance. LUVOTIX® ATUR M 510 has a pseudoplastic flow behavior and is particularly recommended to increase viscosity in the medium shear range.
LUVOTIX® ATUR M 600	Hydrophobically-modified polyurethane thickener based on HEUR	LUVOTIX® ATUR M 600 is a hydrophobically-modified polyurethane thickener for waterborne adhesives, sealants, paints, and coatings that improves levelling, settling and sagging of waterborne formulations. LUVOTIX® ATUR M 600 has a pseudoplastic flow behavior and is particularly recommended to increase viscosity in the medium shear range.
LUVOTIX® ATUR H 800	Hydrophobically-modified polyurethane thickener based on HEUR	LUVOTIX® ATUR H 800 is a hydrophobically-modified polyurethane thickener for waterborne formulations, used in adhesives, sealants, paints, lacquers, and protective coatings to improve properties such as levelling, wet abrasion, and film formation. LUVOTIX® ATUR H 800 has a Newtonian flow behavior and is particularly recommended to increase viscosity in the high shear range. LUVOTIX® ATUR H 800 can be effectively combined with LUVOTIX® ATUR L 200.

Inorganic rheology additives for solvent-based and water-based systems

Naturally-occurring and organically-modified phyllosilicates from the LUVOGEL® series are used in water-based and solvent-based systems for rheology control. The powdered additives are incorporated directly at the beginning of the dispersion process or in the form of pre-gels. Polar chemical activators are sometimes added to improve gel formation in solvent-based systems. Easily dispersible and self-activating LUVOGEL® additives enable fast and successful activation process, without the need of temperature control.

Inorganic rheology additives for solvent-based systems

Product	Description	Application
LUVOGEL® 4	Montmorillonite, organically modified	LUVOGEL® 4 is used as an anti-settling and sag-control agent in low- to medium-polarity formulations such as industrial coatings, do-it-yourself-coatings, construction paints, primers, printing inks, adhesives, and putties. The addition of a polar activator is recommended.
LUVOGEL® 4B	Montmorillonite, organically modified	LUVOGEL® 4B is a variant of LUVOGEL® 4 with higher concentration of organic modification.
LUVOGEL® 7	Montmorillonite, organically modified	LUVOGEL® 7 is used as an anti-settling and sag-control agent in low- to medium-polarity formulations such as industrial coatings, do-it-yourself-coatings, construction paints, primers, and printing inks. The addition of a polar activator is recommended.
LUVOGEL® SA1	Montmorillonite, organically modified	LUVOGEL® SA1 is a self-activating anti-settling agent and rheology additive for solvent-based formulations of a wide polarity range, e.g. in industrial coatings, DIY paints, architectural paints, primers or printing inks.
LUVOGEL® SA10	Montmorillonite, organically modified	LUVOGEL® SA10 is a self-activating anti-settling and sag-control agent in low-polarity aliphatic formulations.
LUVOGEL® ED	Montmorillonite, organically modified	LUVOGEL® ED is an easy-to-disperse additive, which creates a shear-thinning flow profile with thixotropic properties and a slight viscosity increase in formulations.
LUVOGEL® G58	Montmorillonite, organically modified	LUVOGEL® G58 was designed as a rheological and anti-setting additive for unsaturated polyester resins, epoxy resins and vinyl esters, especially in styrene-containing and solvent-containing formulations of different polarities, and also in solvent-free epoxy resin systems.

LUVOPLUS® DA 100	Low molecular weight polymer with amphiphilic properties	LUVOPLUS® DA 100 is a bio-based dispersing agent particularly suitable for the dispersion of organophilic clays (conventional layered bentonites, e. g. LUVOGEL®) during the preparation of pregels.
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Inorganic rheological additives for water-based and dry mix systems

Product	Description	Application
LUVOGEL® W1	Montmorillonite	LUVOGEL® W1 is used in water-based formulations, e.g. adhesives, paints and coatings, cleaning agents, polishes, etc. It produces a pseudoplastic flow profile with thixotropic properties and improves settling behavior and flow control.
LUVOGEL® W3	Montmorillonite	LUVOGEL® W3 is used in water-based formulations, e.g. adhesives, paints and coatings, cleaning agents, polishes, etc. It produces a pseudoplastic flow profile with thixotropic properties and improves settling behavior and flow control.
LUVOGEL® AQ	Synthetic Hectorite	LUVOGEL® AQ is a rheological additive for highly transparent water-based formulations. The main areas of application are industrial coatings and automotive paints – OEM as well as refinish. LUVOGEL® AQ offers excellent stabilisation and orientation of effect pigments.
LUVOGEL® W2N	Synthetic Hectorite	LUVOGEL® W2N is used as a rheological additive in water-based formulations. The main areas of application are industrial coatings and automotive paints – OEM as well as refinish. The products provide excellent stabilisation and orientation of effect pigments.
LUVOGEL® WS1	Synthetic Hectorite	LUVOGEL® WS1 is a synthetic smectite clay modified by an inorganic sodium phosphate. It is used as a rheological additive in water-based formulations.
LUVOGEL® WS2	Synthetic Hectorite	LUVOGEL® WS2 is a synthetic smectite clay modified by an inorganic sodium phosphate. It is used as a rheological additive in water-based formulations.

Inorganic rheology additives for solvent-based and water-based systems

The activation of these rheological additives only depends on the polarity of the solvents.
The powdered additives should be incorporated by high-shear forces using a dissolver.

	Product	Description	Solvent-based and high-solid systems			Water-based systems
			Low polarity	Medium polarity	High polarity	
Powder	LUVOGEL® 4	Organically modified Montmorillonite	●	●	-	-
	LUVOGEL® 4B		●	●	-	-
	LUVOGEL® 7		-	●	●	-
	LUVOGEL® SA1		●	●	-	-
	LUVOGEL® SA10		●	-	-	-
	LUVOGEL® ED		●	●	●	-
	LUVOGEL® G58		●	●	●	-
	LUVOGEL® W1	Montmorillonite	-	-	-	●
	LUVOGEL® W3		-	-	-	●
	LUVOGEL® AQ	Synthetic Hectorite	-	-	-	●
	LUVOGEL® W2N		-	-	-	●
	LUVOGEL® WS1		-	-	-	●
	LUVOGEL® WS2		-	-	-	●

● Product suitable

WOLLATROP®

Inorganic rheology additives for water-based systems

WOLLATROP® are hydrated inverted ribbon silicates used as inorganic thickeners in water-based systems. WOLLATROP® additives are particularly easy to incorporate into formulations thanks to their filamentous and flexible structure. Unlike classic phyllosilicates, WOLLATROP® products develop a stable structure immediately after incorporation, which leads to increased viscosity, especially in the low shear range. WOLLATROP® products are characterized by a high tolerance to changes in ionic strength and pH fluctuations.

Product	Description	Application
WOLLATROP®-S	Ribbon silicates with fine fiber distribution	Preferred use in paints, varnishes, and coatings.
WOLLATROP®-SE	Ribbon silicates with fine fiber distribution	Preferred use in paints, varnishes, and coatings.
WOLLATROP®-M	Absorbent filler based on ribbon silicates	Application as rheology additive in construction products such as mortars, construction and tile adhesives, fillers and filling compounds, but also high-build coatings and wall or facade paints. Particularly suitable for use at high temperatures.
WOLLATROP®-LV	Silicate ribbons, organically modified	Preferred use in water-based coatings with low to medium layer thickness as well as in construction chemicals, such as adhesives or plasters.
WOLLATROP®-S/240	Silicate hybrid	WOLLATROP®-S/240 is an economical rheology additive. WOLLATROP®-S/240 can be used as a multifunctional rheology additive in construction chemicals or high-build coatings that require micro-reinforcement or crack bridging in addition to rheological adjustment.

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