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RHEOLOGY ADDITIVES
LUVOTIX®
LUVOGEL®
WOLLATROP®

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

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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 behaviour should be controlled while good flow on the surfaces should be achieved. 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

Rheological properties such as viscosity and viscoelastic behaviour can be determined with the help of suitable measuring instruments in quality control, 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 material 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 strengths and elastic components.



Figure 1: Ideal viscous (Newtonian) flow behaviour

An ideal-viscous flow profile (Newtonian flow behaviour), in which the viscosity depends only on the temperature but not on the shear rate, is exhibited by only very few liquids and basic formulations.

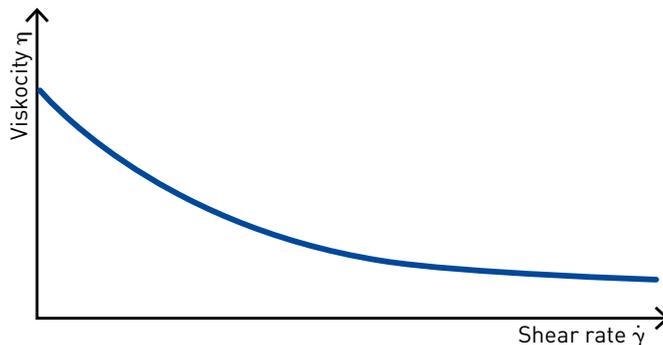


Figure 2: Shear-thinning flow behaviour

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.

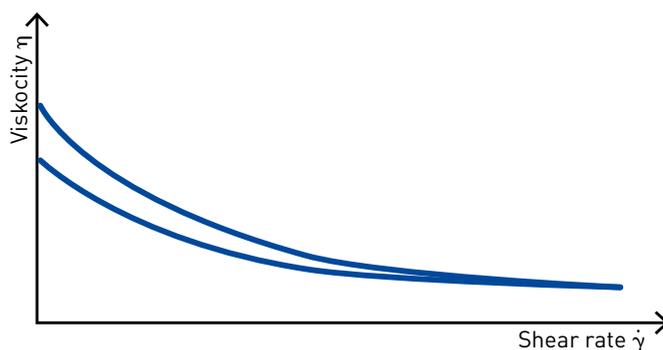


Figure 3: Thixotropic flow behaviour

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, for filling, transportation and storage stability.

A sufficiently high viscosity in the low shear rate range contributes to improved storage stability of the formulations, as settling or floating of particles is prevented. In

addition, the balance between required run-off resistance and desired uniform flow on the surface is influenced by the viscosity.

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	Surface run 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 mainly made from renewable raw materials. The powders are based on castor oil derivatives, fatty acid amides an/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 even 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 has been 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. In powder coating formulations, LUVOTIX® HT serves as a levelling agent.
LUVOTIX® HT-SF	Castor oil derivate, polyamide-modified	LUVOTIX® HT-SF exhibits the same application profile as 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. The material is free-flowing, easily 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. It is suitable for highly filled and 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. Due to its physical-chemical properties, LUVOTIX® VP031 is particularly easy to incorporate and activate.
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	2-pack-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.

Further pastes in other solvents or plasticizers are available on 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 blend	35–65 °C	35–55 °C	–	35–75 °C
Paste	LUVOTIX® P25X	Polyolefin paste	> 45 °C	> 45 °C	> 45 °C	–
TWOK-Thix	LUVOTIX® TK1/CL1	Liquid 2-pack-rheology additive	suitable for all ranges of polarity does not require a particular process temperature			

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 dispersing 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 processes 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	Compare LUVOGEL® 4 – LUVOGEL® 4B contains higher amount of organic component.
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 used as a self-activating anti-settling agent and rheology additive in 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 used as an anti-settling and sag-control agent in low-polarity aliphatic formulations.
LUVOGEL® ED	Montmorillonite, organically modified	LUVOGEL® ED creates a shear-thinning flow profile with thixotropic properties and a slight viscosity increase in formulations.
LUVOGEL® G58	Montmorillonite, organically modified	LUVOGEL® G58 is mainly used as a rheological and anti-setting additive in 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.

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 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® 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

Inorganic rheology additives for water-based systems

WOLLATROP® are hydrated and inverted ribbon silicates are used as inorganic thickeners in water-based systems. The 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 rate 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 fibers, organically modified	Preferred use in water-based coatings with low to medium layer thicknesses as well as in construction chemicals, such as adhesives or plasters.
WOLLATROP®-S/240	Silicate hybrid	WOLLATROP®-S/240 is an economical rheology additive. It 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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