ELEMENTIS

Application Leaflet

THIXATROL® 5020W

Rheology modifier for metallic pigment orientation in aqueous coating systems

Unique chemistry, sustainable solutions

Key Benefits

- Excellent rheology modification and thixotropic build in metallic coatings improved application properties
- Promotes orientation and flip-flop effect of metallic and pearlescent pigments
- Resistant to microbiological and enzyme spoilage
- Improves anti-settling and anti-sagging properties of coatings

Introduction

Good orientation of metallic flakes and pigments, e.g. such as aluminum and pearlescent powders, is key for ensuring the desired metallic and flop effects of metallic and pearlescent finishings. Compared to solventborne systems, aqueous metallic coatings present a higher degree of challenges due to the slow evaporation rate of water.

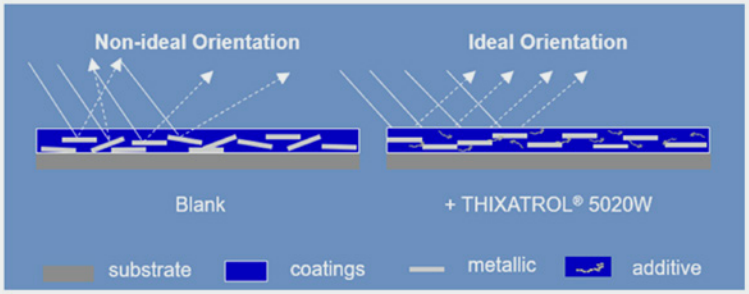
Over the years, different technologies such as ASE (alkali swellable emulsion), hectorites, polyamide and ethylene-vinyl acetate (EVA) copolymer wax emulsions have been developed to promote the orientation of metallic pigments. While polyamide waxes are commonly used in water-based baking paints containing co-solvents, they are less suitable for co-solvent-free or low-VOC coating systems. In this respect, ethylene-vinyl acetate copolymer waxes have gained wider acceptance because of their good features such as low/zero VOC, ease of incorporation, good anti-settling and orientation effect of metallic pigments.

Product features

- Improves pigment orientation and flop index
- Provides thixotropic flow
- Effective low shear viscosity build
- Optimizes anti settling properties
- Improves sag control
- Easy to incorporate
- Solvent free

THIXATROL® 5020W is a rheology modifier providing the optimum orientation of metallic pigments aqueous coatings. It improves the orientation of aluminum- and pearlescent pigments and imparts good thickening and anti- settling effects. THIXATROL® 5020W can be applied in automotive OEM and refinish coatings, plastic coatings and other industrial systems containing aluminum powders.

FIGURE 1: Metallic orientation mechanism



Mechanism

FIGURE 1 shows the effect of THIXATROL® 5020W on orientation of aluminum flakes.

The resulting optical properties are typically being defined and measured as a flop index. The flop index can be described as the change of reflectance of the metallic coating during the measurement through a range of viewing angles. The typical value range starts from 0 up to approximately 17.

The orientation depends strongly on the immobilisation of the effect pigments within the coating film, ideally in parallel to the surface. This is typically obtained as a result of processes which are running throughout the drying process of the coating. Further, the redissolve resistance as also the shrinkage of the drying film can have an influence on the optical properties. To achieve the right orientation of pigment a correctly adjusted rheology plays a major role. In the case of disoriented pigments in the film, poor flop indices and optical appearance is the result caused by light scattering.

THIXATROL® 5020W helps with the metal pigment orientation of within the applied film utilizing the described rheological effects.

Product details

Composition	Modified ethylene-vinyl acetate (EVA) copolymer emulsion
Appearance	Light yellowish, milky opaque liquid
Non-volatile content [%]	18-22
Solvent	water
Density [g/cm³]	~1.0
pH	<5.5
Viscosity [mPas] (Brookfield, 25°C, 50 rpm)	< 500 mPas

Method of incorporation

THIXATROL® 5020W does not require pre-dilution before addition. It is recommended to be added to paint base under mild or medium shear in its delivery form. Aluminum paste is then added at the letdown stage under mild stirring. The product builds moderate viscosity and thixotropic effect and may be used with other rheological additives.

THIXATROL® 5020W is slightly acidic, as such pH value of the coating system will be reduced slightly. Therefore, it is recommended to adjust pH to 9 - 9.5 of THIXATROL® 5020W prior to the addition.

FIGURE 2: Rheology curves

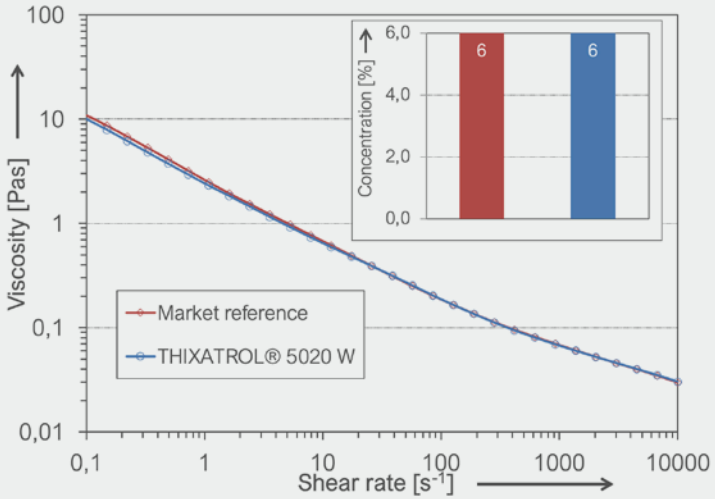
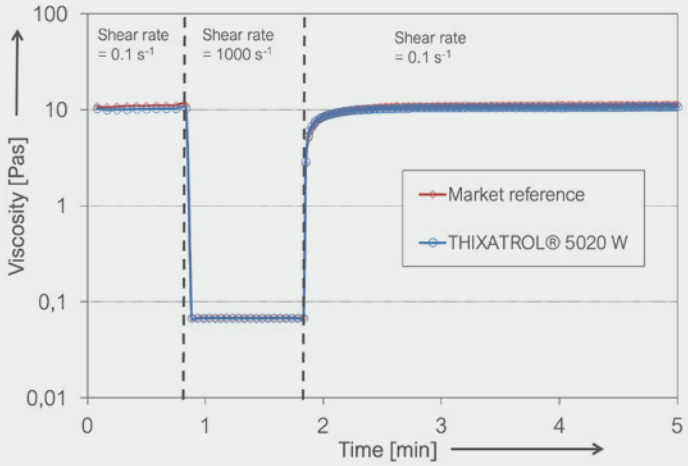


FIGURE 3: Viscosity recovery



Technical evaluation

In the following case study, THIXATROL® 5020W has been compared to a market reference sample based on equal chemistry at a concentration of 6% aqueous PU based metallic coating. **FIGURE 2** shows the rheological characteristics both samples to each other.

However, also the viscosity recovery plays a major role in steering of the metal pigment orientation. In **FIGURE 3** the result of a relevant test can be seen. The measuring period has been splitted in three parts. In the first part low shear rates od 0.1 s-1 have been utilized to determine the behaviour prior to the application. In the second part the shear rate has been set to 1000 s^{-1} to simulate the application. The third step visualizes the samples behaviour after the application. As the entire test has been plotted on a time scale, the time of viscosity recovery of the viscosity at low shear can be directly read of. This time plays a major role in the immobilization process of the metallic pigment.

Both additives, THIXATROL® 5020W and the market reference, provided a certain, fast recovery of the viscosities after shear which indicates also a similar effect on the metal pigment immobilization and orientation, hence, the optical properties.

FIGURE 4: Optical properties

	Market reference	THIXATROL® 5020W
Gloss 20°	88	88
Flop index	13.1	12.9

FIGURE 5: Humidity test results

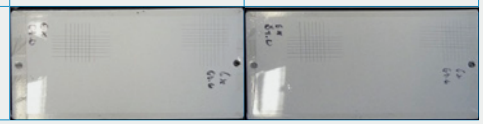
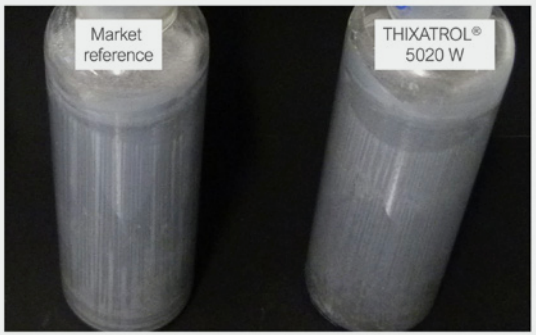
	Market reference	THIXATROL® 5020W
Gloss 20°<	88	88
Cross hatch test before exposure 6 x tape pull off	Gt. 0	Gt. 0
3 days 40°C, 100% humidity		
Gloss 20°<	84 E	84 E
Cross hatch test after exposure 6 x tape pull off	Gt. 0	Gt. 0
Blisters	0 / 0	0 / 0
Remarks	OK	OK
		

FIGURE 6: Storage stability



On the following result (**FIGURE 4**) the optical properties of the test panels, gloss and flop index, with both coatings are shown.

It becomes obvious that both rheology modifiers, THIXATROL® 5020W as well as the market reference show equal influence on the optical properties of the final coating.

In **FIGURE 5** the effect of both rheology modifiers on the adhesion before and after humidity resistance are visualized.

In the upper part of the table the gloss and cross hatch stability prior to the humidity storage is shown. In the below part the data after 3 days of storage at 40°C and

As also noticed in the pervious part of the study, the effect of THIXATROL® 5020W and the market reference material are equal. Further, in none of the humidity test parameters one of the samples failed.

Furtherly the stability of the test coatings was checked. In **FIGURE 6**, the sample are shown after 30 days of storage at elevated temperature of 40°C can be seen.

None of the both tested samples showed any sedimentation or settling of the aluminum pigments. Only the formation of a thin layer of syneresis liquid was noticed.

FIGURE 7: Gassing stability

However, also the influence of the additives on further parameters, apart from the influence on rheological and optical properties, of a coatings play a major role. On of these parameters is the influence on the gassing stability (**FIGURE 7**). The generation of gas (hydrogen) over storage can be a serious issue. The maximum acceptable volume of gas generated over the above storage test period of 30days is 25 ml.

Both tested samples performed quite well in terms of the gassing stability. The generated volumes of gas remained in both cases far below the accepted maximum.

Conclusion

THIXATROL® 5020W is an effective rheology modifier for imparting the right rheological performance in water-based metallic and pearlescent coatings and performs exactly in line with the tested market reference. It efficiently builds low shear viscosity and ensures fast viscosity recovery after shearing. Furtherly, THIXATROL® 5020W provides optimum orientation of metallic pigments after application resulting in excellent metallic optical properties such as flop and gloss. Coatings formulated with THIXATROL® 5020W exhibits excellent storage stability and causes no gassing issues. THIXATROL® 5020W is recommended for use in aqueous automotive basecoats and industrial coatings containing metallic and pearlescent pigments.

Test system

Aqueous Base coat

Raw material	Function	Concentration [%]
PU based emulsion	Binder	39.00
Demin. water	Solvent	44.40 - X
Butylglycol	Co-solvent	0.70
n-Butanol	Co-solvent	1.30
DMEA (10%)	pH-adjustment	2.50
Rheological additive	Rheological additive	X
Aluminium-slurry	Effect	12.10
Total		100.00

Aluminum pigment paste

Raw material	Function	Concentration [%]
Aluminum pigment		43.80
Butylglycol	Co-solvent	38.8
NUOSPERSE® W 30	Dispersing agent	4.1
n-Butanol	Co-solvent	13.3
Total		100.0

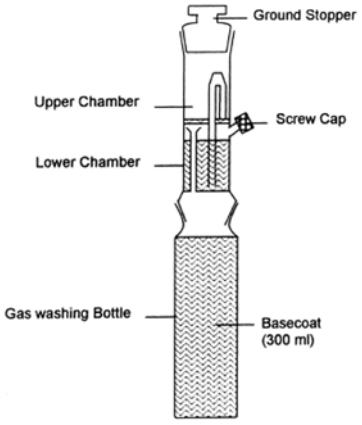
APPENDIX

Test methods

Rheology
Measured by Anton Paar MCR 301, measuring geometry PP 50 at a gap width of 1 mm and a temperature of 23°C.

Humidity resistance
Determined in accordance with DIN EN ISO 6270-2 (3 days, 40°C, 100% humidity; Coating applied at a dry film thickness of 11-13 µm.

Gas generation
- Fill 250 ml of liquid coating into a 300 ml gas washing bottle.
- Add 25 ml of water into the lower chamber of the apparatus.
- Expose the assembled device for 30 days into a bath of 40°C.
- To evaluate the volume of water displaced by the generated gas.
- 25 ml of gas generated over 30 days are the maximum accepted volume.



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June 2024

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