ELEMENTIS

Application Leaflet

RHEOLATE® 299

Highly efficent and
strongly shear-thinning
associative thickener

Unique chemistry, sustainable solutions

Key Benefits

- Highly efficient
- Imparts strongly shear thinning flow behavior
- Excellent sag resistance and anti-settling behavior
- Good flow and levelling
- Limited influence on water sensitivity and corrosion resistance
- Excellent optical properties in the final coating system
- pH independent
- APE- and organotin-free

Composition	polyether polyurethane dispersion in a mixture of water and diethylene glycol monobutyl ether
Color/Form	white liquid
Density	1.04 g/cm3
Viscosity	below 5000 mPa.s, 10 rpm, Sp.3, brookfield RVT
Non-volatile	25% active by weight
Volatile	75% (57% water/18% diethylene glycol monobutyl ether)

Introduction

Non-ionic associative thickeners (polyether polyurethane, polyether polyol and related products) have been used for over thirty years to provide waterborne decorative coatings with balanced properties of flow and levelling, substrate coverage and roller-spatter resistance.

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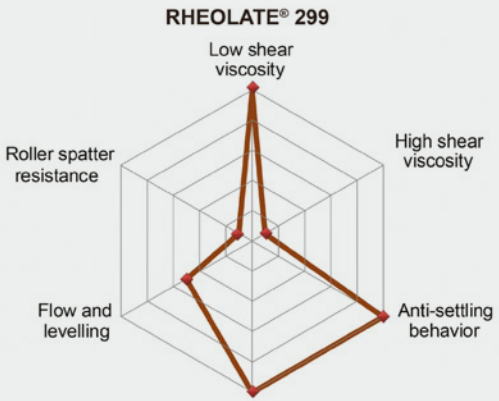
Waterborne industrial coatings require strongly shear-thinning flow for the correct spray and storage characteristics and traditionally contain significant quantities of co-solvent. To meet these requirements, typically alkali swellable emulsions have been used as primary rheological additive. These however, can bring problems of reduced water resistance, even in the dry film, haziness or loss of gloss, and they require careful pH control.

With decreased use of aggressive co-solvents for environmental reasons and the development of more robust associative thickener chemistries, it is now possible to gain their application benefits also in industrial formulations and so enhance the coating's performance. In this document, practical data are presented to show the advantages of formulating industrial waterborne coatings with a new generation non-ionic associative thickener, the RHEOLATE® 299.

FIGURE 1: Application properties given by the new generation associative thickener



Thickener properties

The polyether polyurethane associative thickener polymers are built from a hydrophilic core with hydrophobic capping units. The frequency and chemistry of these caps, together with the overall balance between the hydrophilic and hydrophobic units determine the rheological properties. The more hydrophobic the polymer is, the stronger are the associations it builds and the more shear-thinning is the flow it provides.

Whereas the drive in decorative coatings is for good levelling and spatter resistance resulting from Newtonian flow, in industrial formulations it is more important to have a strongly shear-thinning character with low viscosity at high shear rates. This combination is ideal for spray application as the pumping pressure is reduced and resistance through the nozzle is minimised. This in turn will reduce problems of overspray and also the energy costs. The high viscosity given at rest controls sag, allowing good edge coverage, and reduces pigment settling. The unique associative thickening mechanism, however, still permits enough flow-out and levelling for excellent film appearance. These properties of the RHEOLATE® 299 are summarised in the spider diagram **FIGURE 1**.

Correct choice of the polymer building blocks allows further advantages to be gained from the associative thickener. Unlike the traditional alkali-swellable emulsions, its relatively hydrophobic nature and high efficiency reduce the danger of influencing water sensitivity and so corrosion resistance does not suffer. For the same reason haziness or loss of gloss are avoided. As the polymer is non-ionic, the thickening mechanism is independent of pH, allowing its use even in specialized acidic formulations.

TABLE 1: Efficiency

Additive		RHEOLATE® 299	PEUPU Reference
Loading	[%]	0.35	0.33
Brookfield viscosity			
10 rpm	[mPa.s]	14560	4120
20 rpm		8460	3720
50 rpm		3762	22680
100 rpm		1996	1760
ICI viscosity	[P]	0.4	0.4

FIGURE 2: Waterborne clear-coat thickened with a standard PEUPU or the RHEOLATE® 299 associative thickener

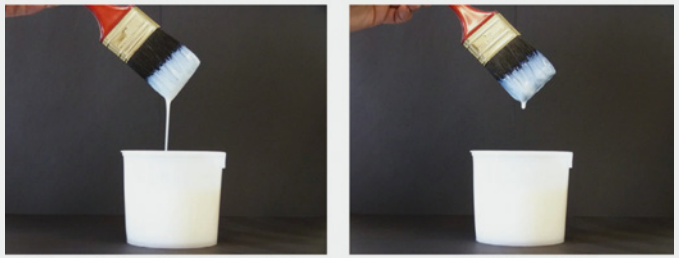
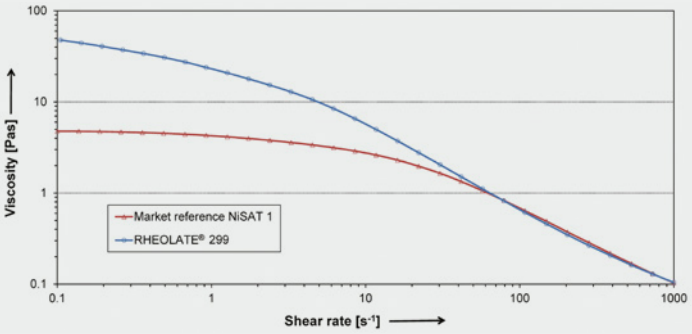


FIGURE 3: Rheograms of the waterborne clear coat with the RHEOLATE® 299 thickener or the reference PEUPU



Practical examples

Waterborne wood clear-coat

RHEOLATE® was incorporated into a waterborne wood clear-coat formulation and compared against a standard polyether urea polyurethane thickener (PEUPU) already promoted for its highly shear-thinning performance. The difference between the resulting systems can easily be seen in **FIGURE 2** where the new additive is giving much more structure at rest. Basic flow behavior data and the efficency are shown in **TABLE 1**.

The RHEOLATE® 299 requires a similar loading to reach the same mid-shear viscosity (Krebs Stormer 100). However low shear viscosity is significantly higher. This is seen most clearly in the rheograms of both coatings shown in **FIGURE 3** that demonstrates the strongly shear-thinning performance of RHEOLATE® 299. The consequence of this is a significantly improved sag resistance as shown in **FIGURE 4**. Levelling and optical properties are not affected.

When an alkali-swellable emulsion (ASE) thickener is used in the same formulation, it causes turbidity and poor resistance to water-droplet staining (poor early water resistance), as shown in **FIGURE 5**.

FIGURE 4: Sag resistance of the waterborne clear-coat formulations

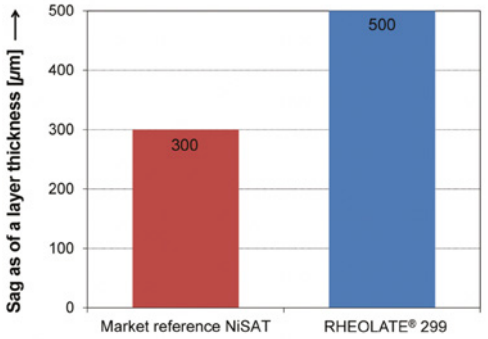


FIGURE 5: Early water resistance of the waterborne clear-coat containing a standard ASE reference or the RHEOLATE® 299 associative thickener

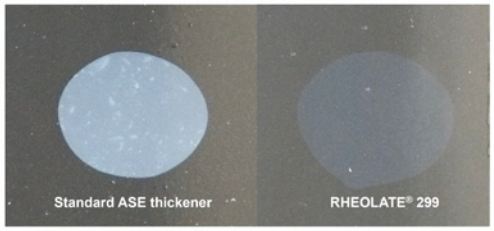
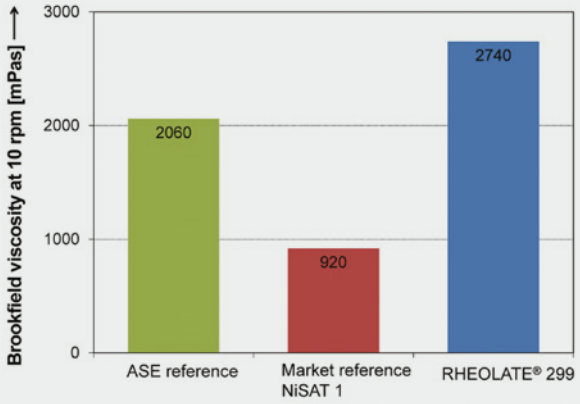


FIGURE 6: Mid shear viscosity



Waterborne industrial top-coat

RHEOLATE® 299 was compared against the standard shear-thinning PEUPU thickener and a bench-mark alkali-swellable product (ASE) in a spray applied waterborne general industrial top-coat.

The rheological data and gloss results at 30 seconds DIN 4 cup viscosity are shown in the following. In **FIGURE 6** it is shown, that although the ASE gives comparable Brookfield flow, it requires a much higher loading than the RHEOLATE® 299 (**FIGURE 7**) and it significantly reduces the gloss (**FIGURE 8**). Full rheograms of the coatings are shown in **FIGURE 9**. The RHEOLATE® 299 gives lowest high-shear viscosity which helps to improve spray performance. On the other hand, the very high low-shear viscosity from the ASE might also contribute to its poorer gloss results.

FIGURE 7: Effectivity

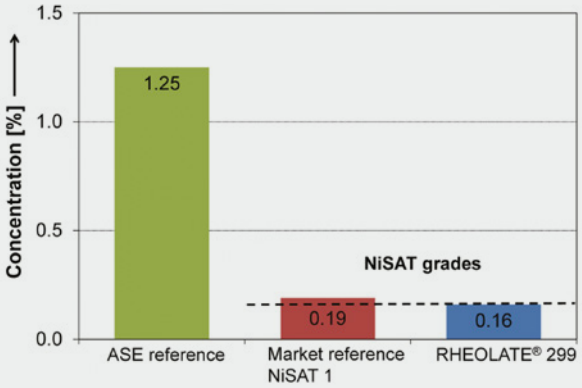


FIGURE 8: Influence on the gloss

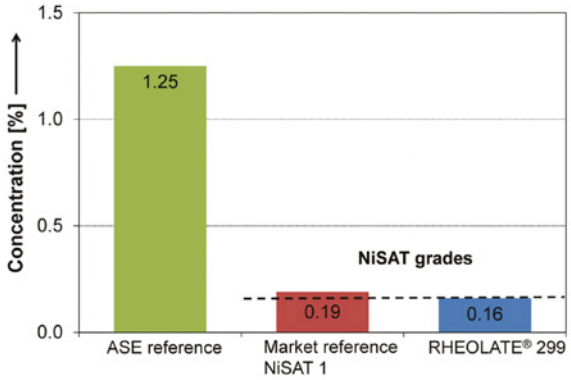


FIGURE 9: Rheograms of the spray-applied waterborne top-coat thickened with the RHEOLATE® 299, a standard PEUPU, or a bench-mark ASE (30s DIN 4 cup)

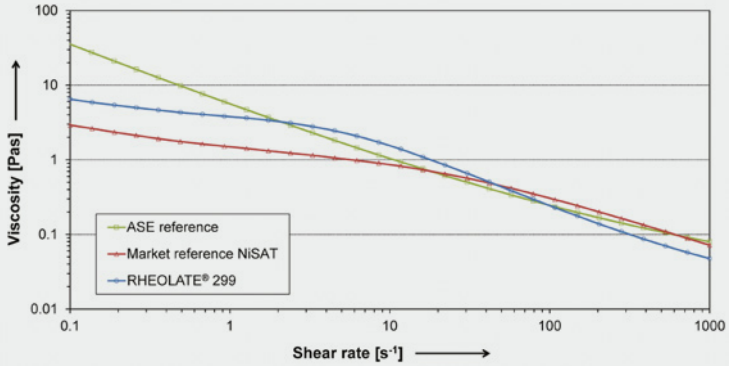
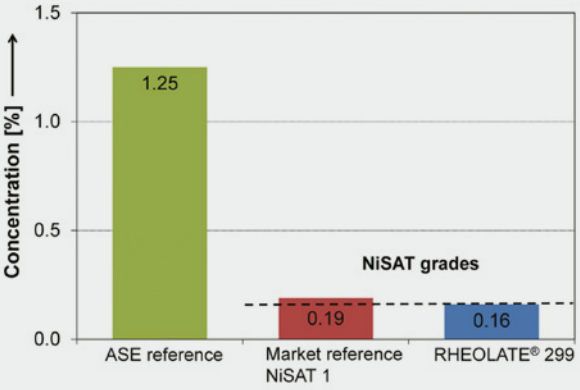


FIGURE 10: Sag resistance (dft) of the spray-applied waterborne industrial top-coat

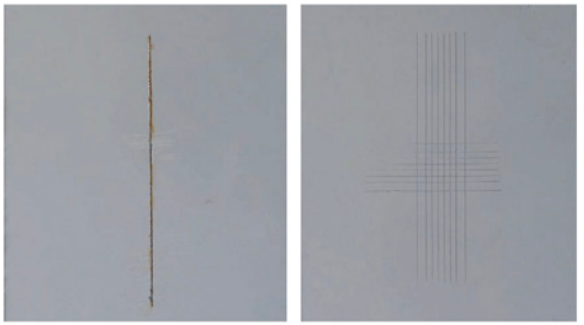


Sag resistance was measured on the spray applied panels (**FIGURE 10**). Again RHEOLATE® 299 gives the best results even though it does not reduce the coating's gloss.

Corrosion (salt-spray) and humidity resistance with the RHEOLATE® 299 associative thickener were evaluated according to DIN EN ISO 9227 and DIN EN ISO 6279-2 respectively. Results are shown in **FIGURE 11**.

The top-coat remains intact during the tests and there is no indication of any adverse effects. RHEOLATE® 299 is clearly suitable for metal coating formulations.

FIGURE 11: Sag resistance (dft) of the spray-applied waterborne industrial top-coat



Salt spray test
DIN EN ISO 9227

Humidity resistance
DIN EN ISO 6270-2

Conclusion

RHEOLATE® 299 demonstrates all benefits in terms of flow and application properties, in industrial coating formulations. It provides excellent shear-thinning flow with low viscosity at high shear rates. This improves spray characteristics, can reduce production costs and maintains sag control without decreasing flow-out or optical properties. Further, due to its nonionic character RHEOLATE® 299 has limited influence on either water sensitivity or corrosion; often problems with the conventional alkali-swellable thickener technology.

RHEOLATE® 299 is suitable for a wide range of industrial waterborne applications including both clear and pigmented spray applied wood and joinery as well as the full range of metal coatings.

NOTE:

The information herein is currently believed to be accurate. We do not guarantee its accuracy. Purchasers shall not rely on statements herein when purchasing any products. Purchasers should make their own investigations to determine if such products are suitable for a particular use. The products discussed are sold without warranty, express or implied, including a warranty of merchantability and fitness for use. Purchasers will be subject to a separate agreement which will not incorporate this document.

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