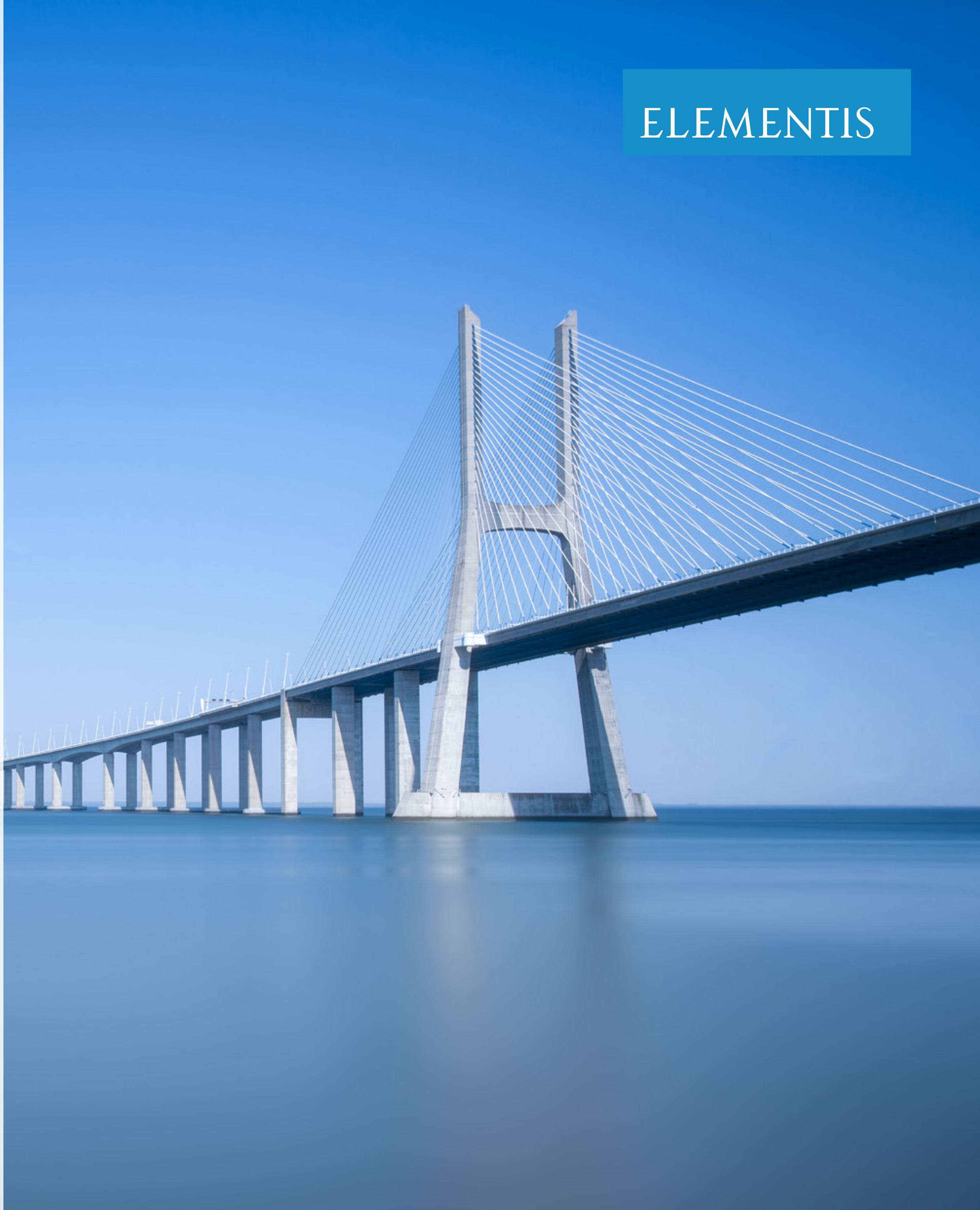
Application Leaflet

RHEOLATE® 658

Pseudoplastic nonionic synthetic associative thickener (NiSAT) providing for very low VOC waterborne decorative and industrial coating systems



Unique chemistry, sustainable solutions

Key Benefits

- Efficient mid-shear viscosity build
- Depending on the system, beneficial for improved color acceptance
- Excellently balance sag, flow and leveling characteristics

TABLE 1

Composition	Polyurethane solution in water
Appearance	Opaque liquid
Specific gravity, [g/ml]	1.03
Active solids, [%]	17.5
Brookfield viscosity (RVT, spindle 4, speed 20 rpm, @25 °C), [mPa·s]	<4000
VOC (ASTM D 6886-03), [%]	<0.01

Introduction

RHEOLATE® 658 is a novel nonionic synthetic associative thickener (NiSAT) providing outstanding rheological properties for waterborne applications. RHEOLATE® 658 works in a broad range of latex chemistries developing high viscosities at low- and mid-shear rates. It fits very well into the latest VOC compliant latex systems and could perform as single thickener without sacrificing flow and leveling.

Features

- Efficient viscosity build at low- and mid-shear rates
- Compatible in various resin systems
- Excellently balanced sag, flow and leveling characteristics
- Outstanding viscosity stability up on tinting
- Easy to use
- Acts pH independent

Target systems

- Zero to low VOC deco paints
- Water reducible paints
- Adhesives and sealants
- Waterborne industrial coatings
- Inks

FIGURE 1: Flow characteristics - Styrene - Acrylic PVC 50 paint

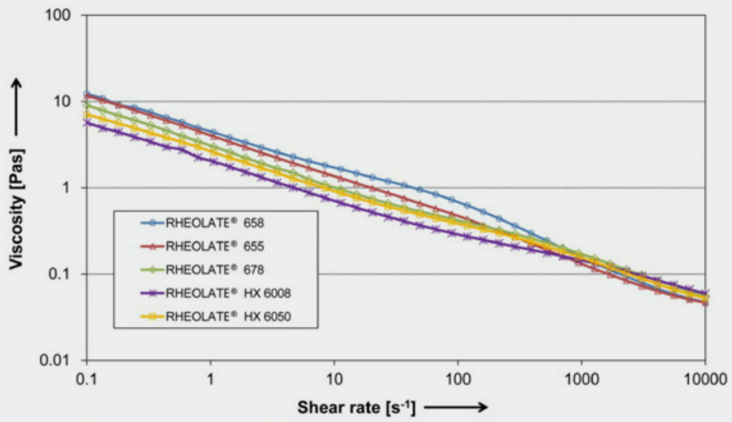
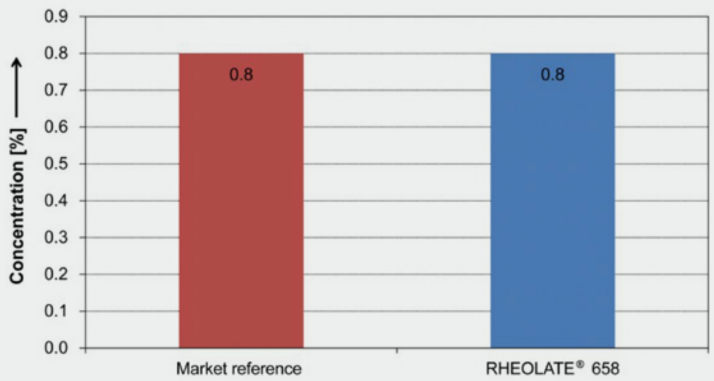


FIGURE 2: Efficiency evaluation - Styrene - Acrylic PVC 50 paint



Incorporation and levels of use

RHEOLATE® 658 can be used as supplied or, if necessary, further diluted with water. Addition can take place at any time during the manufacturing process but incorporation into the mill base before letdown is recommended. RHEOLATE® 658 can be combined with other rheology modifiers, e.g. such as clay based thickeners or cellulosic thickeners .

Due to its associative technology, the efficiency of RHEOLATE® 658 increases with decreasing latex particle size. It is important to assess the effectiveness of RHEOLATE® 658 in the complete system, as performance might also be affected by other raw material ingredients. Further detailed background information on the technology of nonionic synthetic associative thickeners can be found in the Elementis RHEOLATE® HANDBOOK.

Typical use levels of RHEOLATE® 658 are in a range 0.1% to 1.5% (product weight) related to the total system weight.

Products tested

Part 1: RHEOLATE® 658 against Elementis NiSAT range
With respect to the provided flow characteristics, RHEOLATE® 658 performs outstandingly effective thickening in the mid-shear rate range. In this test paint, RHEOLATE® 658 provides at high- and low-shear a similar performance as typically imparted by RHEOLATE® 655. At high-shear rates, RHEOLATE® 658 provides only slightly lower viscosity compared to the proven benchmarks RHEOLATE® HX 6050, RHEOLATE® HX 6008 and RHEOLATE® 678. These standard grades, on the other hand did not achieve similarly high viscosity values at mid- and low-shear rates.

Part 2: Comparison of RHEOLATE® 658 against market references
The **FIGURE 2** displays the concentration required to achieve a Krebs-Stormer (KU) (mid-shear) viscosity of ~100 units in a styrene-acrylic PVC 50 paint.

RHEOLATE® 658 performs equally to the market reference NiSAT grade. Other raw materials

FIGURE 3: Flow characteristics - Styrene - Acrylic PVC 50 paint

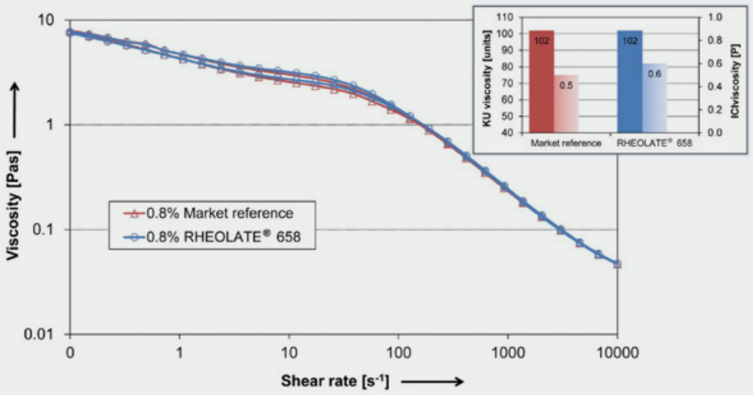


TABLE 1: Application properties - Styrene - Acrylic PVC 50 paint

	Sag resistance [µm]	Levelling 0 = poor 10 = excellent)	Colour acceptance, +1% Tinting Paste [Chroma Chem blue 15:3 WAB] Δ KU – Stability	Rub out (ΔE)
RHEOLATE® 658	400	6	-3	0.82
Market reference	400	6	-3	0.83

FIGURE 4: Effiency evaluation - Vinyl acrylic/ethylene (VAE) based PVC 50 paint

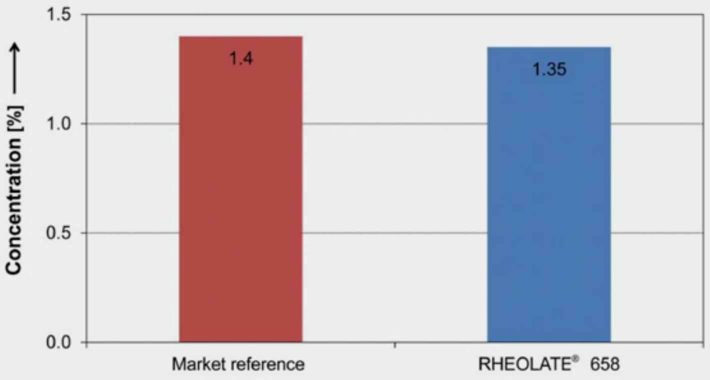


FIGURE 3 shows the flow characteristics of the styrene-acrylic PVC 50 paint, equipped with the individually determined amount of thickener to achieve a Krebs-Stormer (KU) viscosity of ~100 units. The high-shear viscosity at 10000 s-1 (ICI) is also demonstrated. Both, ICI and KU viscosity are plotted in the small graph in the upper right corner.

RHEOLATE® 658 is matching the flow characteristics of the tested market reference NiSAT thickener exactly at equal mid-shear viscosity. The high-shear/ICI viscosity shows only marginal differences between the two products.

In the **TABLE 1**, the application properties such as sag stability, leveling and color acceptance as well as viscosity stability up on tinting is displayed. Detailed descriptions on the relevant test methods can be found in the appendix.

Sag stability and leveling was equal with both, the paint with RHEOLATE® 658 and the market reference. Color acceptance after tinting with 1% of the mentioned colorant was with both in an equally acceptable range. Further, both RHEOLATE® 658 and market reference demonstrated high viscosity stability in case of tinting.

The **FIGURE 4** displays the concentration required to achieve a Krebs-Stormer (KU) viscosity of ~100 units in a VAE based PVC 50 paint.

RHEOLATE® 658 requires slightly lower quantities to achieve the required KU viscosity. This indicates a slightly higher efficiency in comparison to the tested market reference NiSAT product.

FIGURE 5: Flow characteristics - Vinyl acrylic/ethylene (VAE) based PVC 50 paint

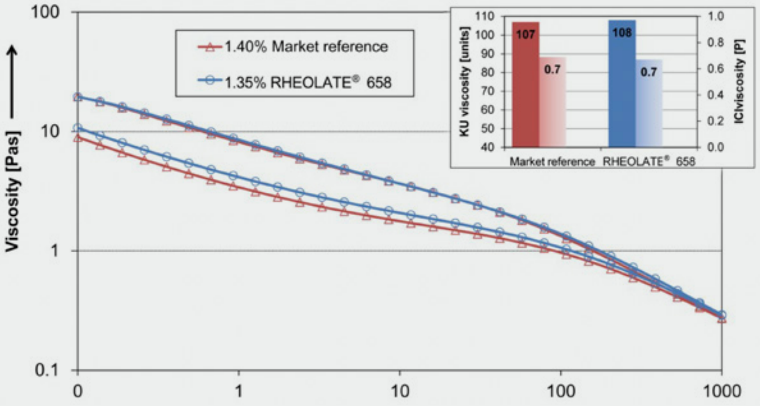


TABLE 2: Application properties - Vinyl acrylic/ethylene (VAE) based PVC 50 paint

	Sag resistance [µm]	Levelling 0 = poor 10 = excellent)	Colour acceptance, +1% Tinting Paste [Chroma Chem blue 15:3 WAB]	
			Δ KU – Stability	Rub out (ΔE)
RHEOLATE® 658	450	6	-10	0.86
Market reference	450	4	-11	1.12

The **FIGURE 5** shows the flow characteristics of the vinyl acrylic/ethylene (VAE) based PVC 50 paint, equipped with the individually determined amount of thickener to achieve a Krebs-Stormer (KU) viscosity of ~100 units. The high-shear viscosity at 10000 s-1 (ICI) is also demonstrated. Both, ICI and KU viscosity are plotted in the small graph in the upper right corner.

The use of RHEOLATE® 658 results in similar flow characteristics than the market reference NiSAT when adjusted to equal KU viscosity. The detected hysteresis area in the graph plotted is in only slightly lower with RHEOLATE® 658. This indicates a slightly quicker recovery of the viscosity after removal of shear forces.

In **TABLE 2**, the application properties such as sag stability, leveling and color acceptance as well as viscosity stability up on tinting are displayed. Detailed descriptions on the relevant test methods can be found in the appendix.

Paints with RHEOLATE® 658 exhibit significantly improved leveling and equal sag stability compared to the market reference modified sample. Further, RHEOLATE® 658 showed remarkable benefits in comparison to the reference in terms of color acceptance. The viscosity stability after was very similar with both tested materials.

Conclusion

RHEOLATE® 658 is a ideal extension of the existing Elementis NiSAT product portfolio. In terms of the provided rheological character, the use RHEOLATE® 658 results in efficient thickening at low- and mid-shear rates combined with a moderate pseudoplasticity flow. RHEOLATE® 658 is suitable to be used in a broad range of latex binders used in decorative and industrial applications. Furthermore, RHEOLATE® 658 fits, due to its very low VOC content, very well into the latest, environmentally friendly paint formulation technology.

In comparison to the tested market reference, RHEOLATE® 658 shows, depending on the binder system, remarkable benefits in terms of

- leveling

- viscosity stability up on tinting

In terms of all other tested parameters, RHEOLATE® 658 performs very close to the tested market reference NiSAT.

TABLE 3: Test formulas based on VAE emulsion and styrene and acrylic emulsion

Raw material	Formulation [%]		Function	Supplier
	Styrene-acrylic	**VAE**		
	PVC 50%	**PVC 50%**		
Millbase stage				
Water	14.90 - X	14.90 - X		
Add under stirring in the denoted order and grind for 15 minutes at 10 m/s				
Calgon® N New, diluted in at 10%	0.10	0.10	Softener	BK Giulini ICL
Biocide	0.10	0.10	In-can preservation	
NUOSPERSE® FX 504	0.10	0.10	Wetting/Dispersing agent	Elementis
Defoamer	0.30	0.30	Defoamer	
Kronos® 2190	5.80	5.80	Pigment	Kronos International
Calcium carbonate various particle size	30.90	30.90	Extender	Omya
Microtalc IT Extra	3.40	3.40	Extender	Elementis Talc
Socal® P2	3.85	3.85	Extender	Solvay
Sipernat 820A	1.50	1.50	Extender	Evonik Industries
Add the below ingredients in the denoted order and mix for further 15 minutes at 15 m/s				
Styrene-acrylic emulsion	32.10	—	Binder	
VAE emulsion	—	32.10	Binder	
Coalescing agent	0.80	0.80	—	
Defoamer	0.10	0.10	Defoamer	
Add the below ingredients and mix slowly for further 10 minutes				
Water	9.70	9.70	—	
Rheological additive	X	X	—	
Sodium hydroxide w (NaOH) = 0.10	0.20	0.20	pH adjustment	
	100.0	100.0		

X is variable in accordance with individual concentration.

APPENDIX

Test formulas

Test methods

- The rheograms are determined using the Anton-Paar MCR 301 rheometer, equipped with measuring geometry PP 50, at a gap width of 1 mm and at a temperature of 23 °C.

- Mid-shear/KU (Krebs-Stormer) and high-shear/ICI (at 10000 s-1) viscosity were measured in accordance with the Elementis standard methods of testing, 24 hours after manufacturing the paints.

- Leveling was determined using test blade 419. The characteristics were judged visually on a scale from 0 to 10. The higher the mentioned number indicates better performance.

- Sag was tested using a test blade with applicable ayer thicknesses of 100 - 1000 µm. The displayed values indicate the maximum applicable layer thickness without runners.

- Color acceptance was measured as ΔE values using the Datalor colormeter. The individual test paint was therefore equipped with 1% ChromaChem 15:3 WAB tinting paste. Viscosity stability was measured as ΔKU and shows the viscosity difference before and after tinting.

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