

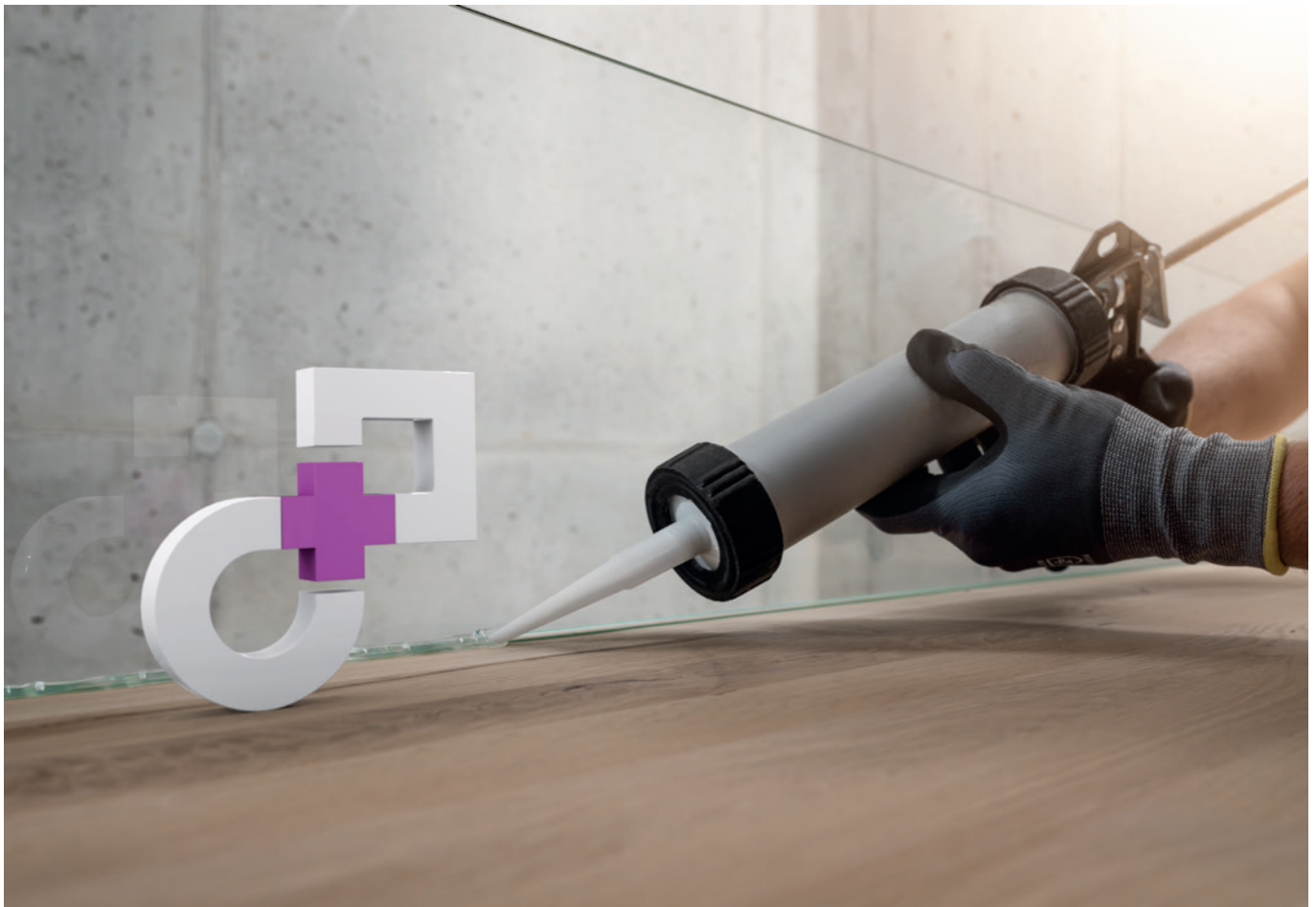
Additives for Water Based Adhesives



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ABOUT US



EVONIK

We are a global player with a presence in local market and offer our customers proven, reliable product quality and supply security – on time and on target.

Our headquarters is in Germany and we have technical centers in North America, Europe and Asia.

INTERFACE & PERFORMANCE

We have broad chemical platforms including siloxanes and organics. Interfacial phenomena at the surface and within the matrix are our expertise and can be evaluated by our specialized test facilities and laboratories.

You can also count on our specialists for process knowledge, physicochemical expertise, scientific studies and regulatory knowledge.

PERFORMANCE STARTS

AT THE INTERFACE

- We develop high performance solutions based on consultation with our customers.
- Long-term relationships built on trust is the basis of our work.
- Come and see us. Please address one of our colleagues to discuss your needs for the adhesives market.

THE ADVANTAGES OF TEGO® ANTIFOAM

Our TEGO® Antifoam products are used both in the production of polymer dispersions¹⁾ as well as in the formulation of related end products.

Many aqueous adhesive dispersions tend to foam due to their chemical composition. The experts differentiate between the creation of macrofoam and microfoam, both of which can be avoided when using products within the TEGO® Antifoam range. This foaming behavior can be critical either during the adhesive formulation step or during adhesive application, such as coating or lamination. In fast application of adhesives, like with gravure

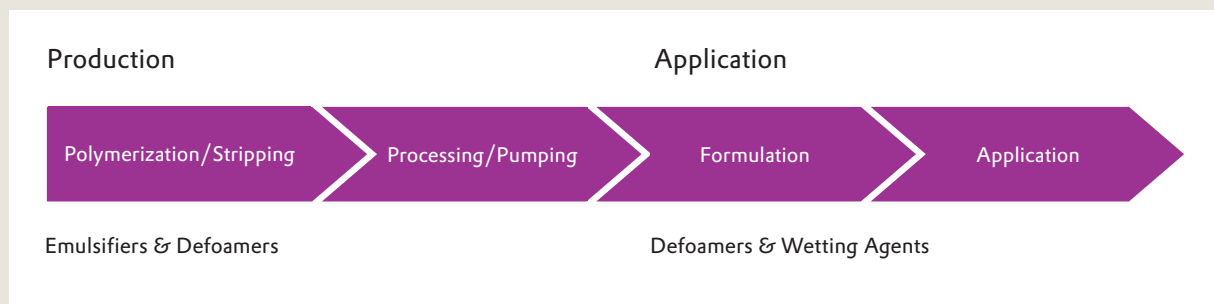
rolls, the occurrence of foam leads to problems directly influencing the productivity. Moreover, a strong foaming adhesive most likely will not meet the required product specifications (adhesion forces, transparency of the adhesive films or a defect free coating). Defoamers are used either to suppress the formation of foam or to effectively destroy foam bubbles once they are formed.

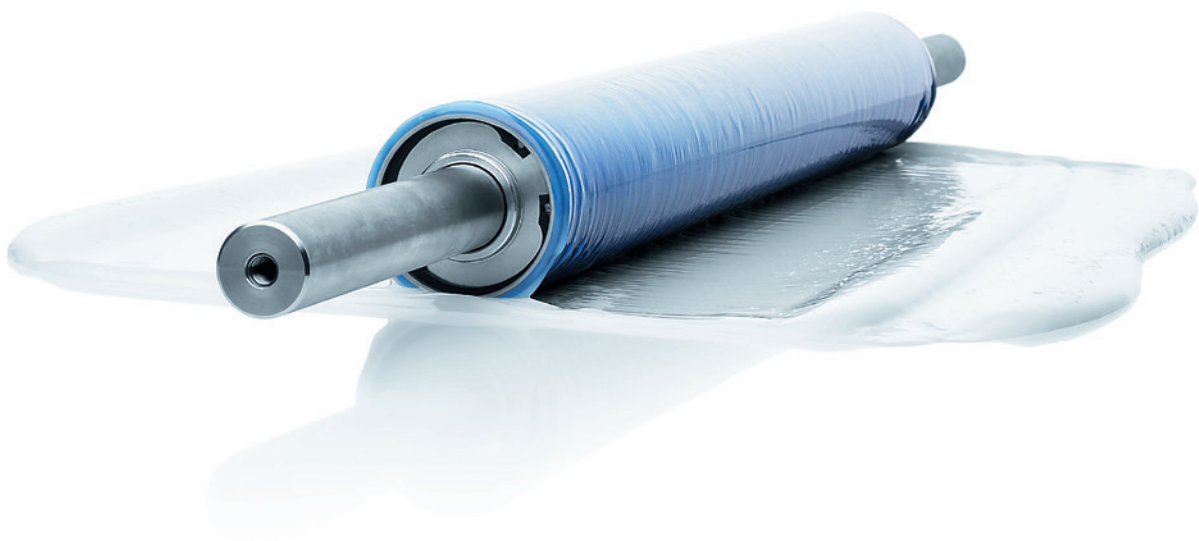
A very small amount of TEGO® Antifoam can not only increase the speed of yours and your customer's production, but also avoid defects and scrap, helping to reduce the production costs.

TEGO® Antifoam products are unique. Carefully selected and formulated base materials provide excellent foam control and maximum compatibility at the same time. The well balanced raw material base leads to a wide range of excellent defoamers, suitable for a multitude of industry applications. Our antifoams do not adversely affect the performance of dispersions and have long-term stability, providing enhanced efficiency even after storage of the formulated dispersions.

¹⁾ Ask us for special information about antifoams for the polymerization process

Figure 1: Our additives are used in the production and formulation of adhesives.





Benefits of the TEGO® Antifoam product range:

- High efficiency
- Attractive cost / performance ratio
- Superior compatibility
- No negative side effects
- Good handling characteristics
- Long-term stability of formulated dispersion
- Broad food contact compliance
- APEO free

SELECTING THE RIGHT TEGO® ANTIFOAM

WE ARE THE FOAM EXPERTS SO YOU DON'T HAVE TO BE.

The foaming tendency of the various base resins and especially the surfactants used in these systems require different antifoams for an optimum level of efficiency and compatibility. With the

help of face to face consultation and the table of recommended products below, we can create a shortlist of products for you. As your formulation certainly is unique, we recommend testing two to

three antifoams to select the ideal product for your formulation.

All TEGO® Antifoams listed below do not contain silicone oil or APEO.

Table 1

PRODUCT	CHEMICAL BASE	DELIVERED AS	FORMULATIONS BASED ON					APPLICATION				
			Acrylates	PVAc/VAE/ PVOH	SBR/NBR	PU	Pressure Sensitive Adhesives	Sealants	Building Adhesives	Laminating & Packaging	Paper, Wood & Furniture	Nonwoven & Hygiene
TEGO® Antifoam KS 53	Vegetable oil	100% active		●	○				●		●	
TEGO® Antifoam 2290	Paraffinic oil	100% active	○	○	●		●				●	●
TEGO® Antifoam 2291 ¹⁾	Paraffinic oil	100% active	●	○	●		●			●	●	
TEGO® ANTIFOAM D 2315 ²⁾	Polyether siloxane	100% active	○	○			●	●		●		
TEGO® ANTIFOAM 4-94 ¹⁾	Polyether siloxane	40% active emulsion	●	○		●	●	●	●	●	●	●
TEGO® ANTIFOAM 4-88 ¹⁾	Polyether siloxane	40% active emulsion	●	●	○		●	●	●	●	●	●
TEGO® ANTIFOAM 2-89	Polyether siloxane	20% active emulsion	●	●		○	●	●	●	●	●	●
TEGO® ANTIFOAM 1488	Polyether siloxane	20% active emulsion	○	○	○		●		●	●	●	
TEGO® ANTIFOAM 204	Polyether siloxane	20% active emulsion			●				●			

● first recommendation ○ second recommendation

1) Superior Food Contact status, please refer to table 3 for an overview

2) Deaerates microfoam

DELIVERING PERFORMANCE: THE PROPERTIES OF TEGO® ANTIFOAM

OUR ANTIFOAMS OFFER GREAT PERFORMANCE IN TERMS OF DEFOAMING AND COMPATIBILITY.

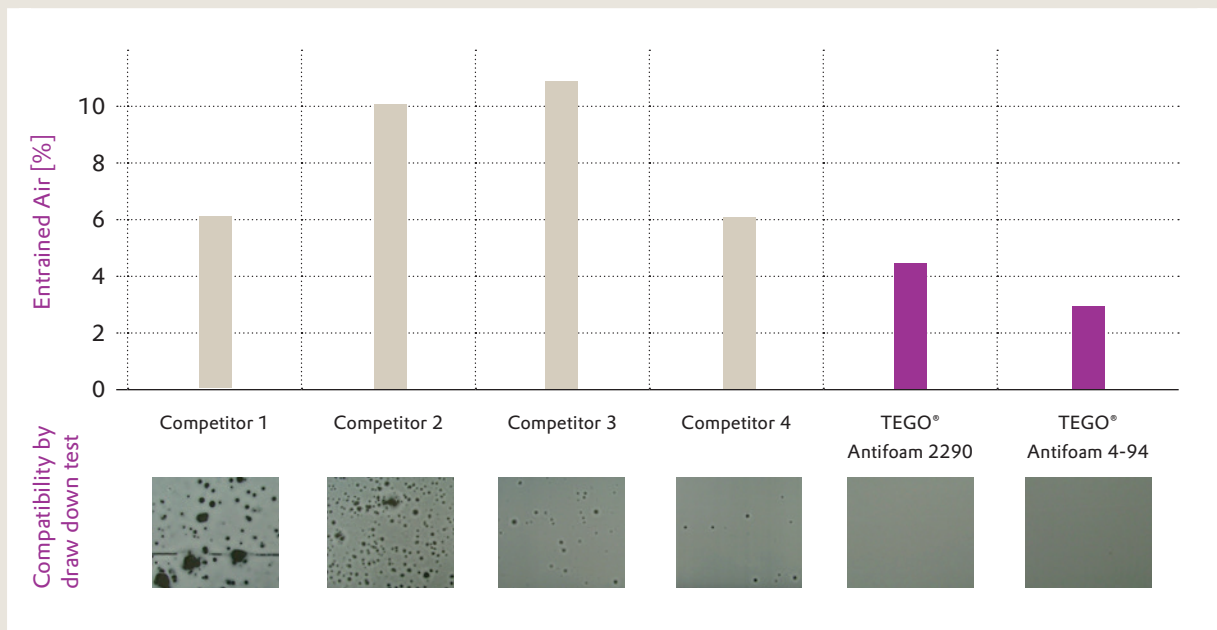
PERFORMANCE OF TEGO® ANTIFOAM IN VINYL ACETATE/ ETHYLENE (VAE) EMULSIONS

Figure 2 represents the most important properties of a defoamer for the ideal

property profile. While you of course want good defoaming performance you also need sufficient compatibility to avoid defects in the final films. The graph represents the entrained air by a stirring test

(bar chart height) and surface appearance in a draw down test (pictures). The TEGO® Antifoam products defoam better and are more compatible than the competition, evidenced in several studies.

Figure 2: Antifoam performance in VAE emulsion

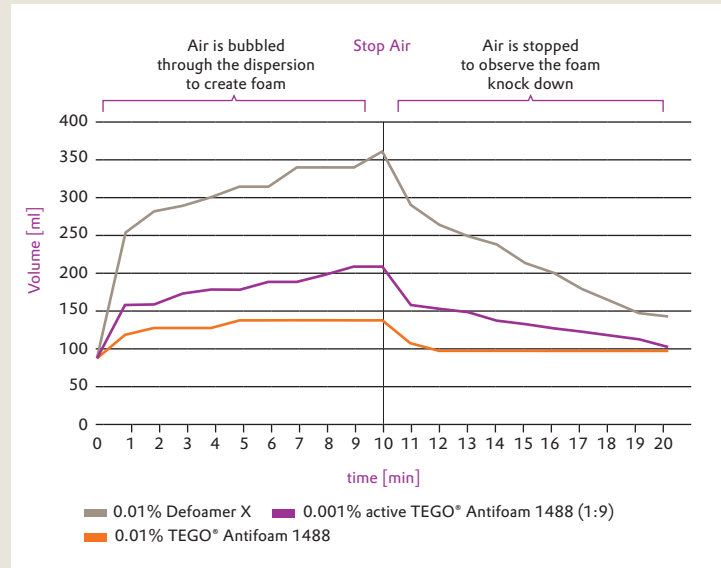


HOLD DOWN AND KNOCK DOWN PERFORMANCE

To evaluate the whole spectrum of defoamer performance we demonstrate a two phase test. In the first 10 minutes, air is blown into the dispersion through a sintered glass (hold down). Then the airflow is switched off and the foam height is observed (knock down).

The grey line shows the foaming tendency of a competitor. There is a lot of foam in both phases. The orange line represents the excellent performance of TEGO® Antifoam 1488 at the same concentration. Even a 10% dilution of TEGO® Antifoam 1488 outperformed the competition in both phases.

Figure 3: Hold down and knock down performance

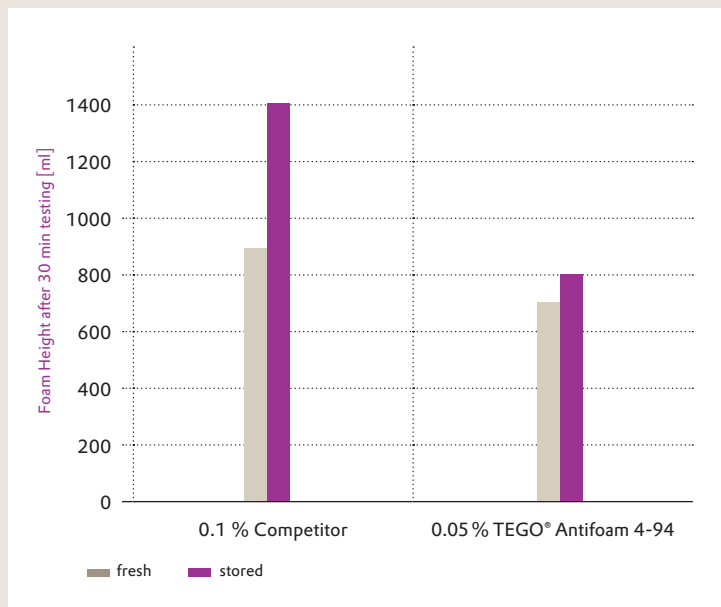


STORAGE STABILITY

An acrylic dispersion including defoamers was stored at 40°C for 14 days. The chart (Figure 4) shows the foam height of fresh (grey) and stored (deep purple) dispersions after 30 minute sintered glass defoamer test. TEGO® Antifoam 4-94 outperformed the competition before and after storage.

These graphics represent only a few examples and a general trend. As formulations differ widely, the effect will be different in the extremes of the spectrum. Please contact us for a recommendation for your system.

Figure 4: Antifoam performance after storage



FOOD CONTACT COMPLIANCE

During the development of our anti-foams, excellent food contact status is a high priority and we address the following standard regulations (table 2).

You will find detailed information about the food contact compliance for TEGO® Antifoam products on the respective Technical Data Sheets (TDS).

If the regulation that you need for your application is not mentioned in the TDS (eg. specific FDA, ISEGA, Swiss ordinance, GB standards of China) it may be that the compliance to that regulation has not been evaluated, yet. If this is the case, please contact us with your questions and the regulation you need to fulfill for your application.

On the next page (table 3) is an overview that displays the Food Contact Status regulation current at the time of printing this brochure. As evaluations change from time to time we recommend to check our website following the QR code or URL for the latest status, or contact us.

Table 2: Overview of important food contact regulations

REGULATION	DESCRIPTION
EU Regulation 10/2011	Plastic materials and articles intended for contact with food
BfR XIV and XXXVI	Polymer dispersions
FDA 175.105	Adhesives
FDA 175.300	Resinous and polymeric coatings
FDA 176.170	Paper and paperboard in contact with aqueous and fatty foods
FDA 176.180	Paper and paperboard in contact with dry food

Table 3: Food contact status of TEGO® Antifoam (at time of printing)

PRODUCT	EU REGULATION 10/2011	BFR XIV	FDA 175.105	FDA 175.300	FDA 176.170	FDA 176.180
TEGO® Antifoam KS 53	●	●	●	●	○	○
TEGO® Antifoam 2290		●	●	●	●	●
TEGO® Antifoam 2291	●	●	●	●	●	●
TEGO® Antifoam D 2315	●	●	●	●	●	●
TEGO® Antifoam 4-94	●	●	●	●	●	●
TEGO® Antifoam 4-88	●	●	●	●	●	●
TEGO® Antifoam 2-89		●	●			
TEGO® Antifoam 1488		●	●			
TEGO® Antifoam 204	●	●	○			

● fully compliant ● compliant with restrictions ○ compliance expected, under evaluation

WETTING AGENTS



In order to spread the adhesive across the surface, wetting agents are an important part of an adhesive formulation.

We offer different kinds of products based on our versatile technologies of organomodified siloxanes and organic chemistry. We can create the property

profile you need for your application. Whether it is extremely good wetting, low dynamic surface tension for curtain coating or a standard sulfosuccinate, we have what you need.

We also provide special wetting agents which have such low foaming tendencies

that they can be considered defoamers. This Gemini surfactant could be a novel solution for your challenging applications. Come talk to us.

Table 4: Characteristics of our wetting agents

PRODUCT	SURFACE TENSION [MIN/M] STATIC/DYNAMIC	ANTI-CRATER	HUMACTANT	PENETRATION	FOOD CONTACT	INITIAL DOSAGE	REMARKS
TEGOPREN® 5840 Organomodified Siloxane	21/53	•		•	ISEGA, FDA	0.3–0.5%	Universal product, medium foaming
TEGOPREN® 5890 Organomodified Siloxane	39/54				EU 10/2011, BfR, FDA	0.3–0.5%	Universal product, medium foaming
TEGO® Surten W 111 Alkoxyolate	29/42	•	•	•	ISEGA	0.3–0.5%	Curtain coating, low foaming
REWOPOL® SB DO 75 Sulfosuccinate	32/51				BfR, FDA	0.8–1.2%	Standard wetting agent, high foaming

Figure 5: Solving wetting issues with Evonik additives

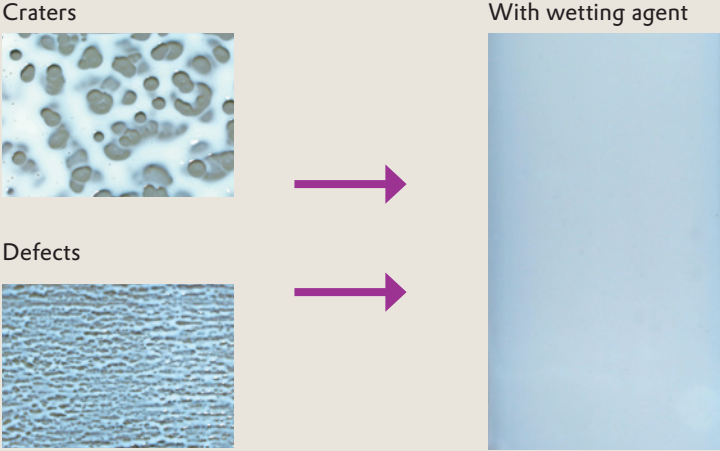
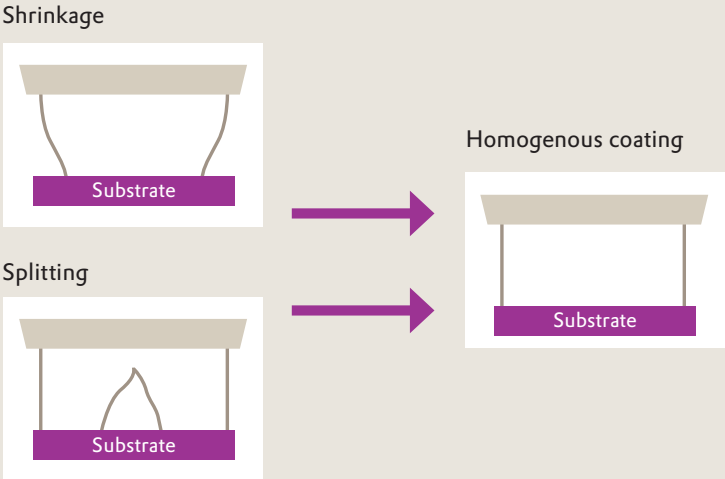


Figure 6: Optimizing curtain coating with TEGO® Surten W 111



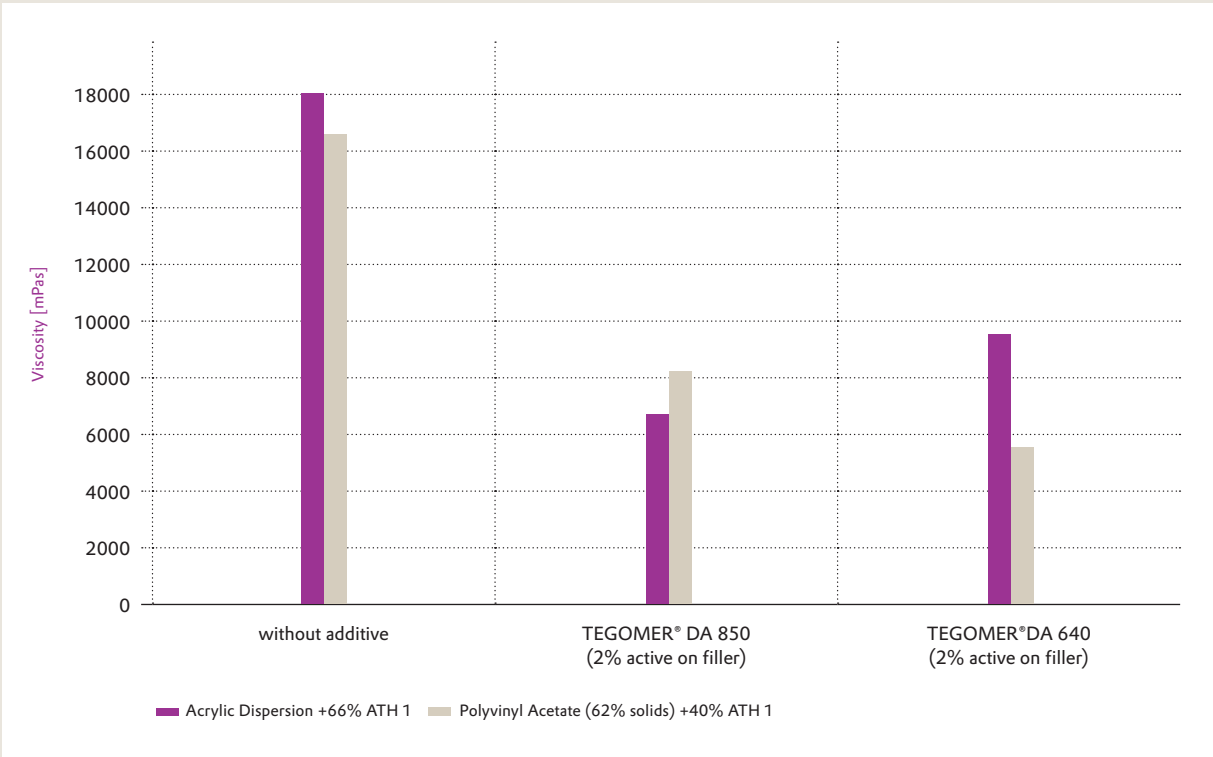
DISPERSANTS

Significantly lower the viscosity and achieve better processing by applying our additives to formulated dispersions. This also applies for food contact.

Our dispersants TEGOMER® DA 850 and TEGOMER® DA 640 are suitable for dispersing chalk, alumina trihydrate (ATH), silicates and other inorganic fillers.

Typical dosages are between 0.5-2.0% additive active on filler content. TEGOMER® DA 850 and TEGOMER® DA 646 are highly efficient for the dispersion of organic pigments and even for conductive carbon black grades.

Figure 7: Viscosity at shear rate 10 1/s



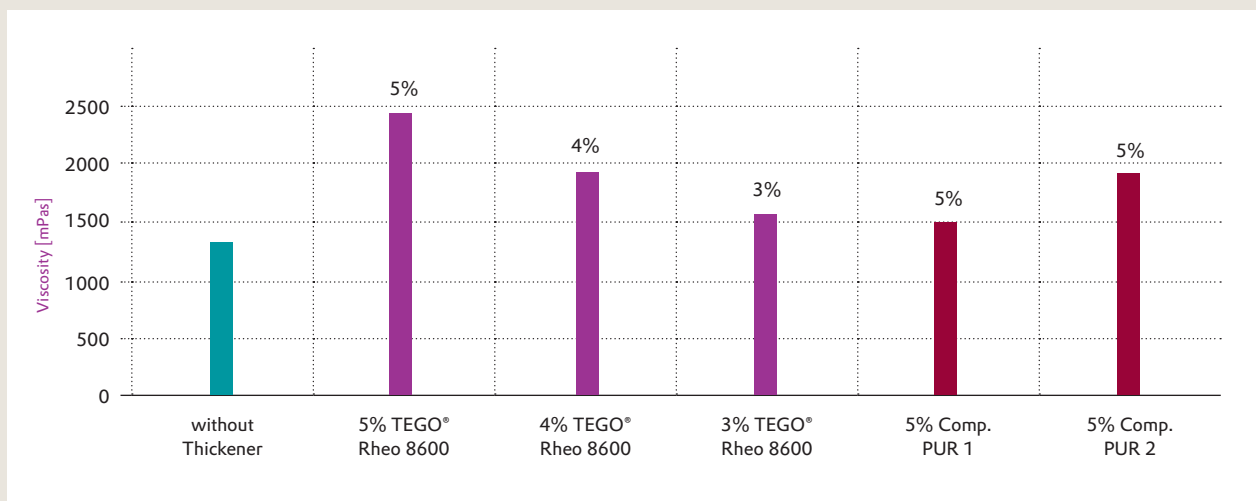
RHEOLOGY ADDITIVES

TEGO® Rheo 8600 is fully compliant with EU 10/2011 and can be applied on all kinds of acrylics and even for Vinyl Acetate/Ethylene (VAE) Emulsions.

In acrylic dispersions TEGO® Rheo 8600 is 25-50% more efficient than other PUR thickeners and it outperforms acrylic thickeners regarding electrolyte stability and water resistance.

It shows efficient thickening even at low pH-values which is needed for speciality acrylics and especially for polyvinyl acetate based emulsions.

Figure 8: Viscosity in acrylic dispersion at shear rate 100 1/s



Benefits of TEGO® Rheo:

- No solvents
- No emulsifiers
- Stable against electrolytes
- Good water resistance
- Suitable on a broad pH range (3-11)
- Good performance in acrylics, PVAc & VAE

OUR EXPERTISE

WE PROVIDE OUR CUSTOMERS EXCELLENT TECHNICAL SUPPORT. BASED ON SPECIFIC TEST METHODS FOR ADDITIVES AND FOR ADHESIVES

SPECIFIC ADHESIVE TEST METHODS

For pressure sensitive adhesives and flexible packaging applications, we have equipment available to measure values for adhesion, cohesion and tack according to Finat test standards.

Additionally we are able to measure the bonding strength of adhesive joints by the use of our Zwick equipment.

GENERAL TEST METHODS

We have vast experience evaluating the properties of surface active materials. Routine evaluation of antifoams, wetting agents, thickeners or dispersing aids is part of our daily work.

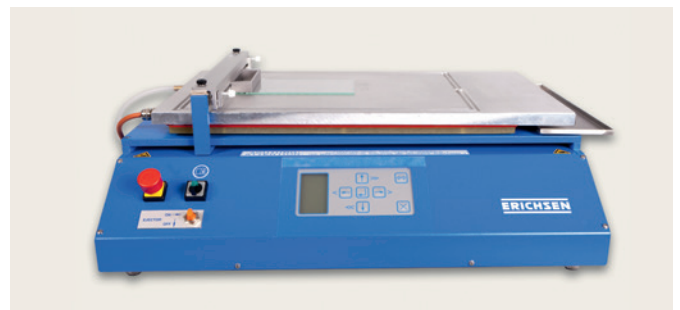
Our laboratories are well equipped with a variety of test methods, including but not limited to standard defoamer tests,

viscosity measurements, evaluation of wetting properties and microscopic evaluations.

These evaluation methods enable us to provide our customers excellent technical support to help solving their greatest challenges



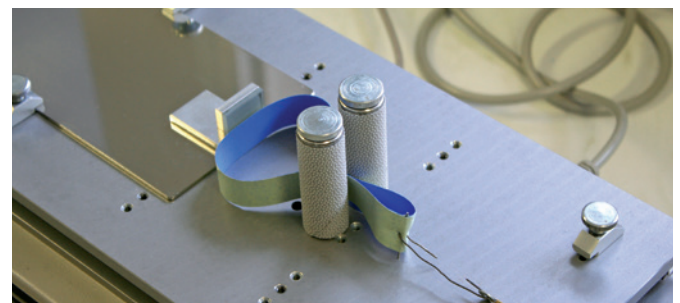
Stirring Test



Draw Down Test



Adhesion (Finat 1 & 2)



Loop Tack (Finat 9)

Europe | Middle East | Africa

Evonik Operations GmbH
Goldschmidtstraße 100
45127 Essen
Germany
Phone +49 201 173-2665
Fax +49 201 173-1990
www.evonik.com

Asia | Pacific

Evonik Specialty Chemicals Co., Ltd.
55, Chundong Road
Xinzhuang Industry Park
Shanghai, 201108
PR China
Phone +86 21 6119-1125
Fax +86 21 6119-1406

The Americas

Evonik Corporation
7801 Whitepine Road
Richmond, VA 23237
USA
Phone +1 804 727-0700
Fax +1 804 727-0855

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