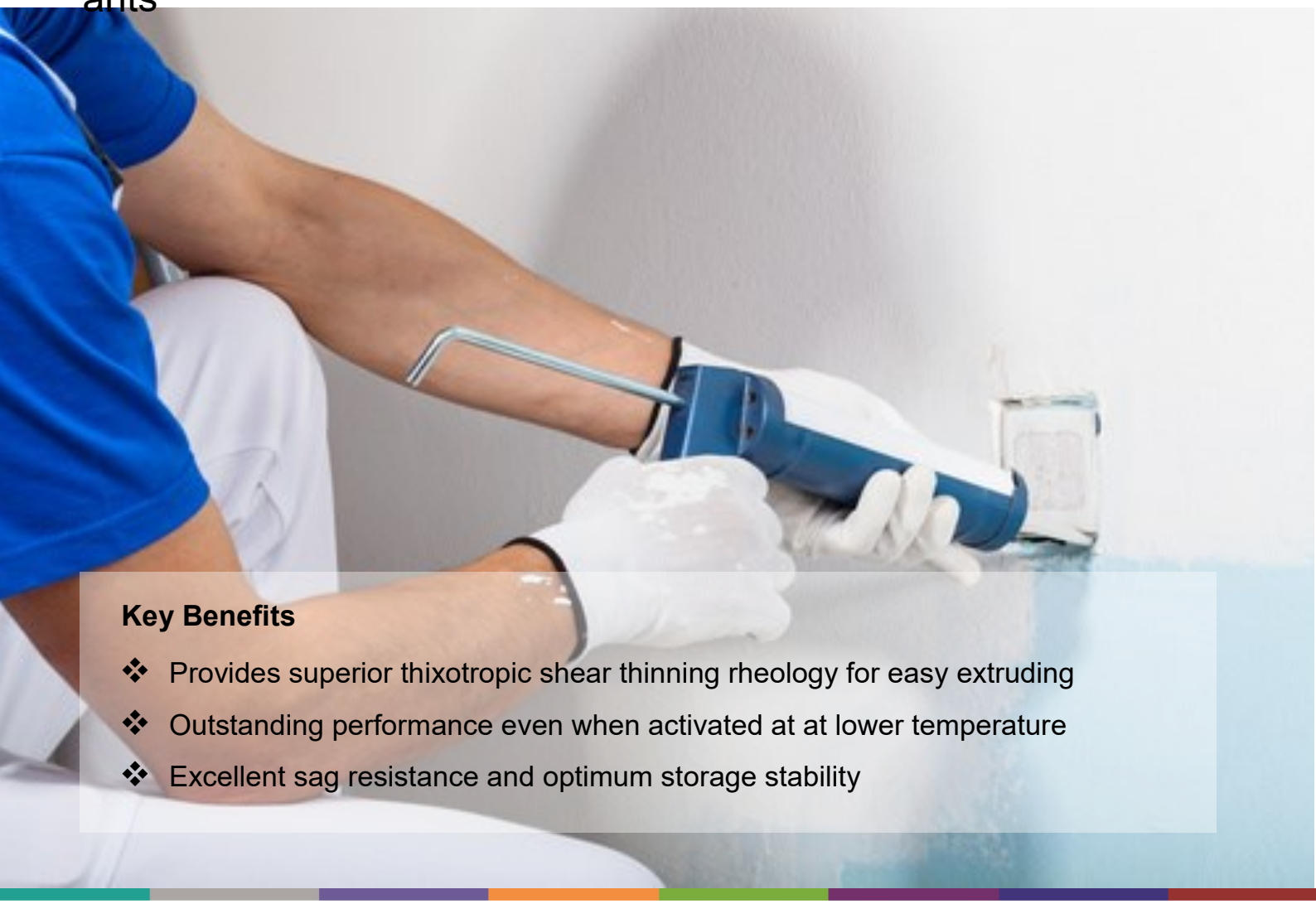
ELEMENTIS

A global specialty chemicals company

Application Leaflet

# THIXATROL® Max

## Rheology modifier for MS polymer based adhesives and sealants



**Key Benefits**

- Provides superior thixotropic shear thinning rheology for easy extruding
- Outstanding performance even when activated at at lower temperature
- Excellent sag resistance and optimum storage stability

## Introduction

MS Polymers are based on silane-terminated polyether combining the performance of silicones and polyurethanes. Those systems are typically free of solvents and isocyanates and therefore exceptionally environmental friendly. MS Polymers are one component, moisture curing materials providing, due to their unique properties, ideal solutions for the formulation of adhesives and sealants.

- Outstanding mechanical properties
- Excellent durability due to high flexibility and weather resistance
- Excellent aging performance
- Can be applied at almost all weather conditions
- Non staining, therefore no discoloration of the substrate
- Good overpaintability
- Adhesion to many different substrates
- Outstanding flexibility of the cured material

THIXATROL® Max is an organic thixotroping agent based on a special diamide wax providing outstanding key benefits for MS Polymer based systems:

- Efficient cost effective rheology control
- Excellent thixotropic shear thinning rheology for ease of application by gun and tool
- Exceptional slump and sag control
- Outstanding long term package stability; no gellation in the cartridge observed
- Excellent performance even at lower temperature activation

## THIXATROL® Max

| | |
|---|---|
| **Composition** | Organic thixotrope based on special diamide wax |
| **Appearance** | Off white fine powder |
| **Active substance [%]** | 100 |
| **Density [g/ml]** | 0.25 |
| **Recommended range of activation temperature [°C]** | 60-90 |

## Levels of use

Typical use levels of THIXATROL® Max in MS Polymer systems are in a range of 0.5% to 5.0% by weight on total formulation. The exact use levels usually vary depending on the region. In European formulations normally approximately 3.0% are formulated. In US systems typically 0.5 to 1.0% are used. Asian formulation, especially Japanese systems, usually contain up to 5.0%.

## Mechanism & Incorporation

To exhibit optimum performance, THIXATROL® Max needs to develop a colloidal dispersion structure below).

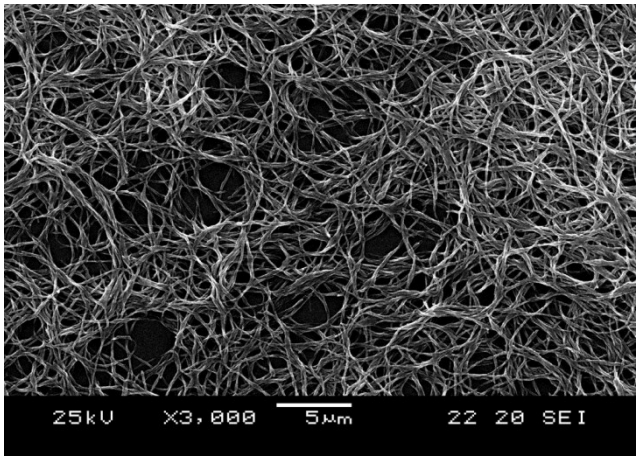



**Figure 1: Diamide colloidal network**

To reach this network stage THIXATROL® Max requires certain activation conditions, such as dwell time, high shear and elevated temperature. To identify the ideal activation temperature an individual ladder study is recommended.

In MS Polymer formulations, THIXATROL® Max is typically added from the begin of processing along with the binders, plasticizers, fillers/extenders and pigments. After activation at the respective conditions further ingredient, such as water absorbent, adhesion promoters and catalyst are added and incorporated individually.

The recommended range of activation temperature for THIXATROL® Max in the present system acts in a range in between 60°C and 90°C. For the lower activation temperature range, THIXATROL® AS 8053 has to be preferred.

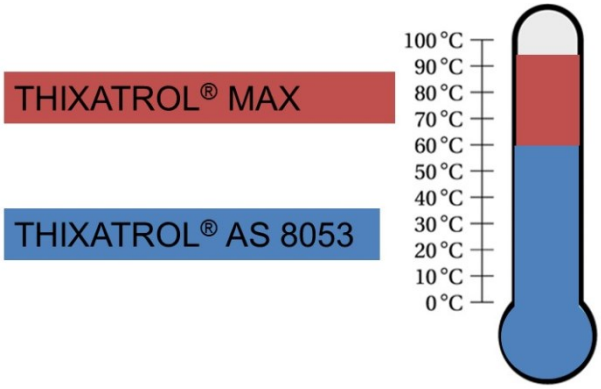



**Figure 2:** Activation temperature range

## Practical examples

In this leaflet the applicability of THIXATROL® Max in a MS Polymer based sealant system is illustrated in comparison to a leading Market reference rheological additive as well as a further competitive product. Both competitive products are based on diamide/polyamide technology.

The additives were incorporated and activated at different temperaturs to compare performance differences.

In all cases the concentration of the individual rheological additve was 3.5% related to the total formulation.

| Grade | Activation temperature [°C] | Viscosity [Pas] at 0.1 $s^{-1}$ | Viscosity [Pas] at 100 $s^{-1}$ | Sagging (profile) | Application properties |
|---|---|---|---|---|---|
| THIXATROL® Max | 90 | 8160 | 41.6 | stable | easy to apply |
| | 70 | 6740 | 35.0 | stable | very easy to apply |
| Competitor 1 | 90 | 4590 | 34.8 | stable | easy to apply |
| Competitor 2 | 90 | 5540 | 47.6 | stable | easy to apply |

**Table 2: Application results overview**

THIXATROL® Max provided strong viscosity build from activation temperatures of 70°C. Samples with the market benchmark and the competitive product remained on a significantly lower viscosity level even when activated at markedly higher temperature of 90°C. THIXATROL® Max generated, when activated at 90°C, a further viscosity increase.

All samples demonstrated sag and slump stablility when applied in a wider joint. However, the material with THIXATROL® Max gave markedly better application properties, especially when activated at 70°C. In this case the tackiness on the tool and the ease of application was noticeably improved.

These findings were also underline by the rheological data as shown in the following.

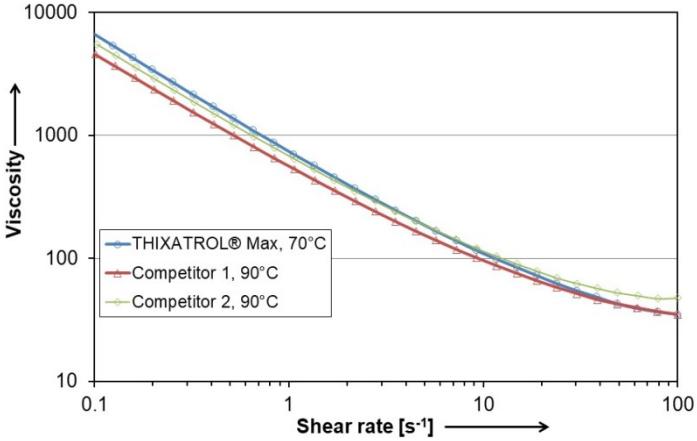



**Figure 3: Rheological properties**

THIXATROL® Max showed equal viscosity build at mid shear rate range compared to the market benchmark even at markedly lower activation temperature of 70°C. The furtherly tested competitive product achieved significantly lower viscosity even when activated at higher temperature.

THIXATROL® Max provided by far the highest viscosity at low shear rates and the strongest shear thinning flow character. These properties indicate excellent sag and slump stability as well as superiour extruding properties.

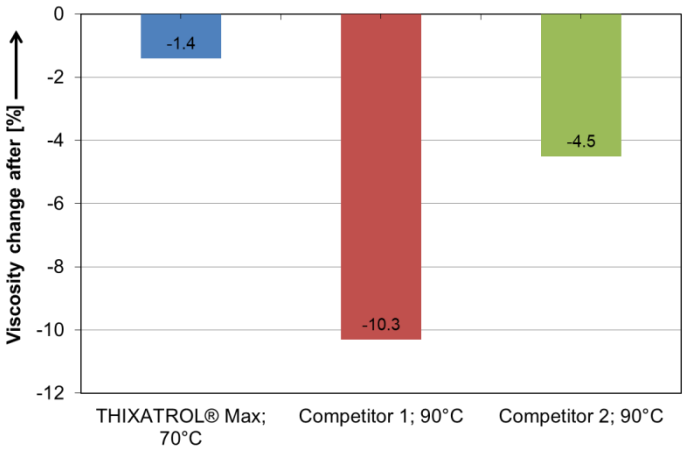



**Figure 4: Viscosity stability on storage**

THIXATROL® Max provided almost stable viscosity over two weeks storage time. Both other tested grades, especially the competitor, gave a noticeable viscosity loss.

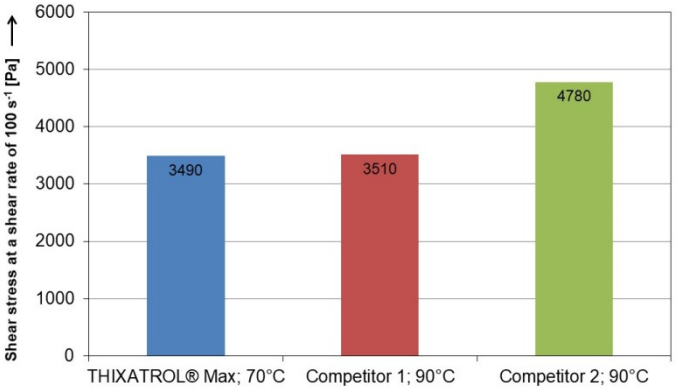



**Figure 5: Shear stress at high shear rates**

Shear stress at higher shear rates can be seen as an indicator for the properties in the cartridge in during the extrusion. The lower the shear stress during the application, the more material can be extruded within a time frame. Consequently, the extrusion becomes easier.

The sealant with THIXATROL® Max required markedly lower forces to induce flow than the sample with the marked benchmark. The of the competitive product resulted equally low forces compared to THIXATROL® Max. However, in this case the viscosity at other shear rates were markedly lower.

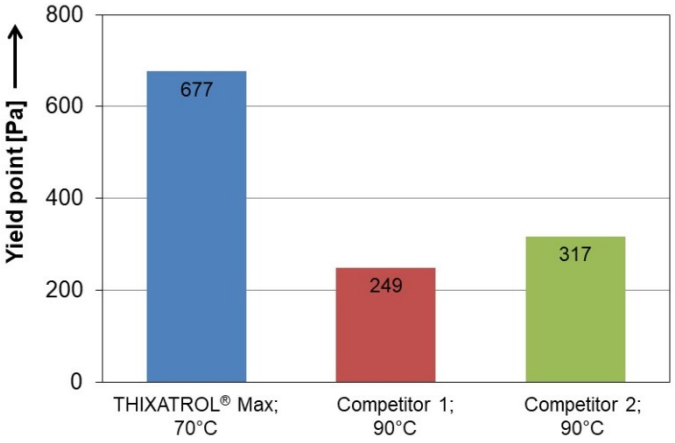



**Figure 6: Yield point**

THIXATROL® Max provided noticeably higher yield point compared to the market benchmark and the competitive product.

# Conclusion

THIXATROL® Max clearly outperformed the marked benchmark and the competitive product.

THIXATROL® Max provided the strongest shear thinning flow and the highest viscosities at low shear rates. Also markedly improved stability and application properties were noticed. All these findings were underlined by rheological data such as increase yield values and lower forces to induce flow.

THIXATROL® Max showed its benefits already when activated at significantly lower temperature of 70°C compared to 90°C in case of the market benchmark and competitive product. The lower activation temperature allows higher throughput and cost effective production.

Kaneka, a main producer of MS Polymer binder systems, approved and recommended THIXATROL® Max in an earlier study. The respective report is available on demand.

In case a system requires lower activation temperature than 60°C, the application of THIXATROL® AS 8053 is recommended.

# Appendix

### Test methods

All displayed rheological data were generated with the Anton Paar MCR 300 rheometer, using the measuring geometry PP 25 (plate/plate; 25 mm diameter, profiled spindle) at a temperature of 23°C and a gap width of 0.5 mm.

- The shear stress at higher shear rates demonstrated the force necessary to induce flow. The lower the plotted value the lower is these force. This data are also an indication for the viscosity at higher shear.
- Viscosity before and after storage was compared at a shear rate of 10 $s^{-1}$.
- Determination of the yield point was performed increasing the shear stress constantly. The yield value was recorded as the respective force when the deformation curve pattern was disrupted.

Sag/Slump stability and workability were measured applying the sealant into a metal channel of a width of 2 cm. The application properties like stickiness on the tool, surface quality and force required were compared. The sag resistance was evaluated after drying for 24 h in a vertical position.

### Formulation

| Ingredients | Concentration [%] | Function | Supplier |
|---|---|---|---|
| MS Polymer S 203 H | 15.0 | Binder | Kaneka |
| Carbital 110 S | 50.5 | Extender | Imerys |
| Kronos 2190 | 3.0 | Pigment | Kronos Int |
| **Rheology modifier** | **3.5** | **Rheology modifier** | **various** |
| MS Polymer S 303 H | 10.0 | Binder | Kaneka |
| Jayfex DIUP | 16.5 | Plasticizer | Exxon Mobile |
| Adding after cooling down, temperature depending on activation temperature | | | |
| Dynasilan VTMO | 0.7 | Water scavenger | Evonik |
| Adding after cooling down, temperature depending on activation temperature | | | |
| Dynasilan DAMO-T | 0.5 | Adhesion promoter | Evonik |
| Catalyst | 0.3 | Catalyst | various |

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**North America**
Elementis
469 Old Trenton Road
East Windsor,
NJ 08512, USA
Tel:+1 609 443 2500
Fax:+1 609 443 2422

**Europe**
Elementis UK Ltd.
c/o Elementis GmbH
Stolberger Strasse 370
50933 Cologne, Germany
Tel:+49 221 2923 2066
Fax:+49 221 2923 2011

**Asia**
Deuchem (Shanghai) Chemical Co., Ltd.
99, Lianyang Road
Songjiang Industrial Zone
Shanghai, China 201613
Tel:+86 21 5774 0348
Fax:+86 21 5774 3563