ELEMENTIS

A global specialty chemicals company

Application Leaflet

M-P-A® Anti-settling additives

Highly efficient anti-settling additives for highly pigmented non-aqueous systems

Key Benefits

- Outstanding anti-settling properties
- Easy to incorporate, no upper temperature limit during activation
- Long term storage stability

Introduction

The M-P-A® product family is covering a group of anti-settling additives for non-aqueous systems based on a polyethylene way technology. The brand name M-P-A® is very traditional and abbreviates **M**ulti **P**urpose **A**dditive.

Our M-P-A® grades are recommended as anti-settling additives for various types on non-aqueous systems, e.g. coatings. In addition it imparts some sag control without affecting the low shear to mid shear viscosity. At the recommended concentration, M-P-A® products do not detract from other coating properties such as levelling, gloss, corrosion resistance and durability as well as adhesion and film flexibility.

M-P-A® grades are easy to add to systems during the manufacturing process, ideally during the millbase processing. As most other organic additives, M-P-A® requires elevated temperature and high shear incorporation over a certain dwell time for the full activation. However, compared to e.g. castor waxes only a minimum temperature needs to be obtained. However, no upper limit of the activation temperature needs to be respected.

Currently two products are available. M-P-A® 60 X utilizes the active polyether wax in a pasty form. M-P-A® 2000x has been delivered as a liquid so that it can poured directly into the formulation during manufacturing.

Benefits and Features

- Easy to incorporate
- Excellent anti-settling properties at low use levels
- Long term stability
- Enhanced sag control
- Stability at high stoving and storage temperature
- Non hygroscopic

Chemical and physical data

	M-P-A® 60-X	**M-P-A® 2000-X**
Composition	Organic compound based on polyethylene wax	
Appearance	Opaque, white soft paste	Opaque, off white liquid
Active content [%]	24	20
Solvent	Xylene	
Specific gravity [g/cm³]	0.87	0.88

Structure and function

M-P-A® grades have been based on a straight chain of ethylene complexes and are in the delivery form available in a solvent carrier. As supplied, the ethylene based molecular structure is a crystalline matrix. After the activation, M-P-A® products provide pigment suspension by chain entanglement. This non-chemical bonding supports the pigment/extender suspension in the liquid column by an increase of the elastic character in the rest. As their is virtually neither hydrogen bonding nor a colloidal dispersion structure, these products have only a minor effect on the viscosity at low to medium shear rates.

While the pigment suspension might not be fully supported, M-P-A® efficiently prevents hard bottom settling in order to make the system easily to be redispersed. In case absolutely no setlling can be tolerated, a combination with either an organic thixotrope out of the THIXCIN®/THIXATROL® series or the or the BENTONE® organoclay product family is recommended.

Care must be taken with M-P-A® 2000x in Zinc rich system as the product is not completely free of water.

Incorporation and activation

Proper activation of M-P-A® occurs typically in three steps (*Figure 1*).

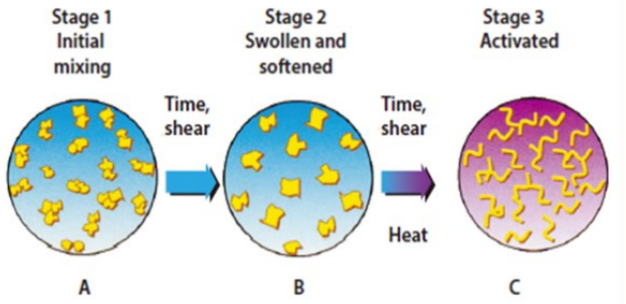

Figure 1: Activation

It is shown that an ideal activation usually starts with introduction into the grinding vehicle (resin and solvent) in order to ensure homogeneous incorporation to the system (Stage A). By the application of high shear, the M-P-A® additive is furtherly softening and swelling (Stage B). With continued shear and heat development above the required minimum temperature for at least 15 minutes, the initial crystalline form is extended into a straight chain (Stage C).

The required temperature in case of M-P-A® and M-P-A® 2000x is in a range of around 45°C and has been required to achieve the full efficiency. Please note, none of the M-P-A® is grades is subjected to seeding. Therefore there are no upper temperature restrictions.

It is recommended to add the M-P-A® loading as early as possible to the grinding process at the highest possible shear in order to obtain the required temperature and to extend the dwell time to the longest possible extend. This described dispersing time should be at least 15 to 30 minutes.

After activation the structure now provides chain entanglement which will minimize pigment and extender movement in the carrier vehicle.

Note, M-P-A® grades do not produce false body effects.

Practical results

A case study has been carried out in a solvent based 2c epoxy coating the performance with M-P-A® 2000 X. Activation of of the M-P-A® 2000 X was done during the millbase processing at high shear rates and 45°C of activation temperature (*Figure 2*).

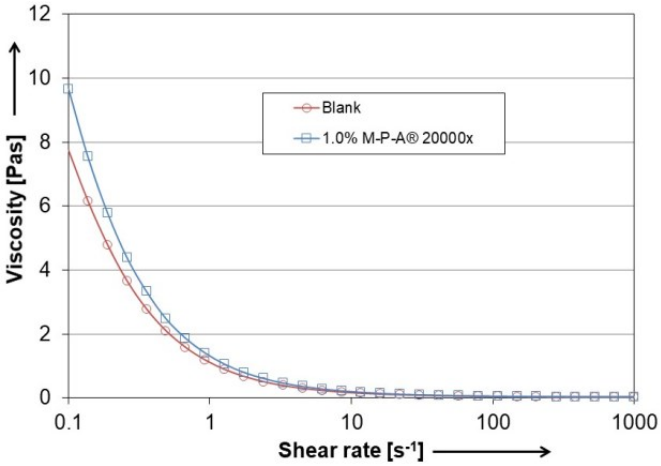

Figure 2: Influence on the viscosity build

It becomes visible the use of 1.0% of M-P-A® 2000 X is causing only a slight viscosity increase of the epoxy coating.

However, as visible in *Figure 3*, the effect on the storage stability is much more significant.

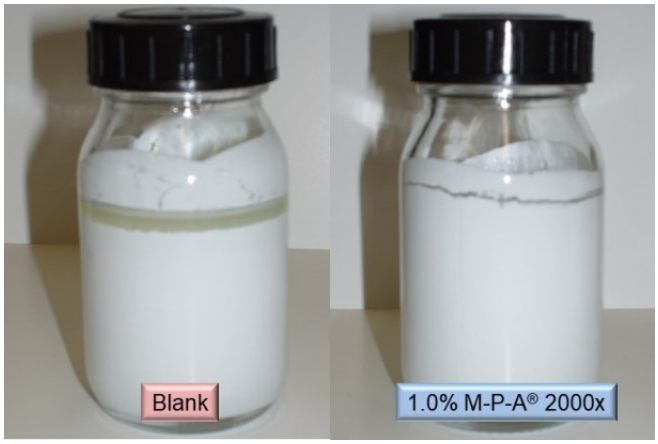

Figure 3: Storage stability

The coating formulated with 1.0% of M-P-A® 2000 X has been stable after 2 weeks storage. However, the material formulated as blank shows a significant amount of phase separation as well as the formation of a bottom deposit.

In *Figure 4* the results of an oscillatory test of the samples is visualized. Such tests are typically carried out in order to obtain information of the viscoelastic characteristics of the material. For the so called shown frequency sweep, the strain rate has been preset to a value of 0.1%. This strain, or deformation, value has been previously determined in an amplitude test. This ensures that the test conditions are acting within the Linear-Viscoelastic-Range (LVE).

The displayed damping factor curve has been plotted over the angular frequency , also called tan delta value, is above 1, the fluid behavior of the sample is dominant and indicates that practically no structure is relevant, the system flows. If the damping factor acts below 1, the elastic behavior of the sample is dominant and indicates the presence of an internal structure. A strong structure indicates excellent sag stability and should consequently correlate with the results generated in practice.

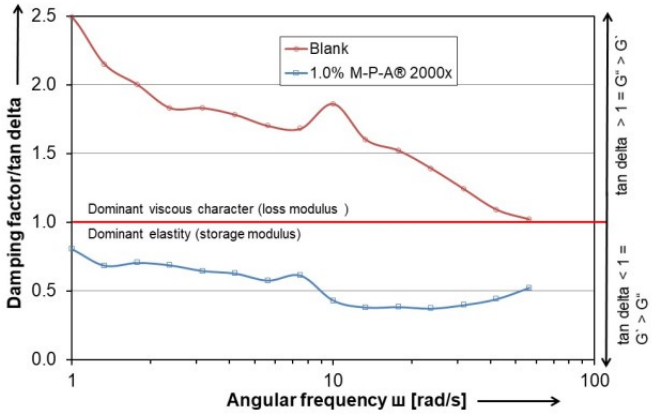

Figure 4: Frequency sweep

By the use of 1.0% of M-P-A® 2000 X the test system experiences a significant shift of the rheological performance towards a domination of the elastic character over the tested angular frequency range.

These data are correlating with the practical findings displayed in *Figure 3*.

However, also a positive influence on the sag control can be noticed by the use of M-P-A® 2000 X (*Figure 5*).

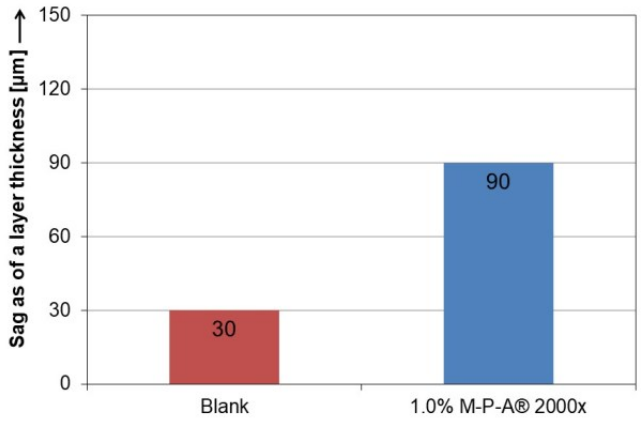

Figure 5: Sag control

The use of M-P-A® 2000 X results in a noticeable increase of the sag stability.

Conclusion

Polyethylene wax based anti-settling agents out of M-P-A® series are easy to incorporate during the millbase processing of coatings manufacturing. Only a minimum activation temperature of above 45°C applied alongside with high speed dispersion is required. No upper temperature limit has to be respected.

As shown on the example of M-P-A® 2000 X, sedimentation of particles can be eliminated with only a minor influence in the systems viscosity. In parallel the sag control can be also noticeably increased.

All the described findings can be underlined by viscoelastic data displaying a significant incline of the elastic conditions.

Appendix

Test methods:

Rheology measurements

Determined using the Anton-Paar MCR 301 rheometer, equipped with PP 50 measuring geometry at a gap width of 1 mm, at a temperature of 23°C. In case of the oscillatory, frequency sweep data shown an fixed strain/deformation rate of 0.1 % was pre-adjusted.

Sag control

Sag stability tested using test blade 1000 -100µm; the larger the bar, the better the result.

Test formulation:

Component A	
Epoxy resin, diluted 75% in Xylene	37.9
Xylene	10.00-**X**
Methyl isobutyl ketone	5.4
n-Butanol	4.1
Rheological Additive	**X**
DAPRO® FX 2060	0.2
Titandioxid	5.5
Barium sulfate extender	28.0
MICROTALC® IT Extra	8.9
Total:	100.0
Component B	
Hardener – Polyamide, 70% in Xylene	30.7

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