DRIVING HIGHER PERFORMANCE

WITH ULTRA-HIGH SOLIDS EPOXY SYSTEMS FOR LONG-TERM ASSET PROTECTION

Epoxy coatings has a successful track record in heavy duty marine and protective coatings, due to the combined offerings of excellent corrosion and chemical resistance. As global environmental drivers become firmly established, the coating industry is faced with the constant challenge of providing solutions which can comply with emerging VOC regulations. One trend for compliance is to migrate traditional solvent based to high solids coatings. In addition, the overall performance attributes associated with current epoxy systems need to be improved to meet emerging industrial application needs. Many competitive high solid epoxy systems typically use non-reactive plasticizers such as benzyl alcohol or alkyl phenols to enable full chemical conversion of the polymer matrix.

While this approach allows for reduced solvent demand, this approach does not always address the market need for long-term, in service performance. Under certain conditions, these modifiers have the potential to migrate out of the coating over time, potentially negatively impacting the mechanical properties of the coating leading to reduced flexibility and an increase in the stress build. Consequently, the potential for a coating to deteriorate in performance is increased depending upon in-service conditions, a factor which needs to be addressed when formulating coatings based on such technologies.

Evonik leveraged it's understanding of amine chemistry and developed a new platform in which the plasticizer is bonded within the amine backbone. Incorporation of this amine technology into Ancamide® 2769 curing agent enables 0 g/l VOC coatings to be formulated where additional non-reactive plasticizers are no longer required. Epoxy coatings based on this curing agent deliver excellent corrosion protection as well as providing long-term conservation of the mechanical properties of the coating, the latter ensuring the predictable performance necessary for delivering long-term asset protection (Table 1) .

Figure 1 shows the storage modulus of clear coatings based on Ancamide® 2769 vs a conventional high sold curing agent as a function of temperature. The initial DMA scans have been obtained after 2 weeks ambient cure.

Figure 1
DMA (dynamical mechanical analysis) evaluation of the mechanical properties of polyamide clear coats.

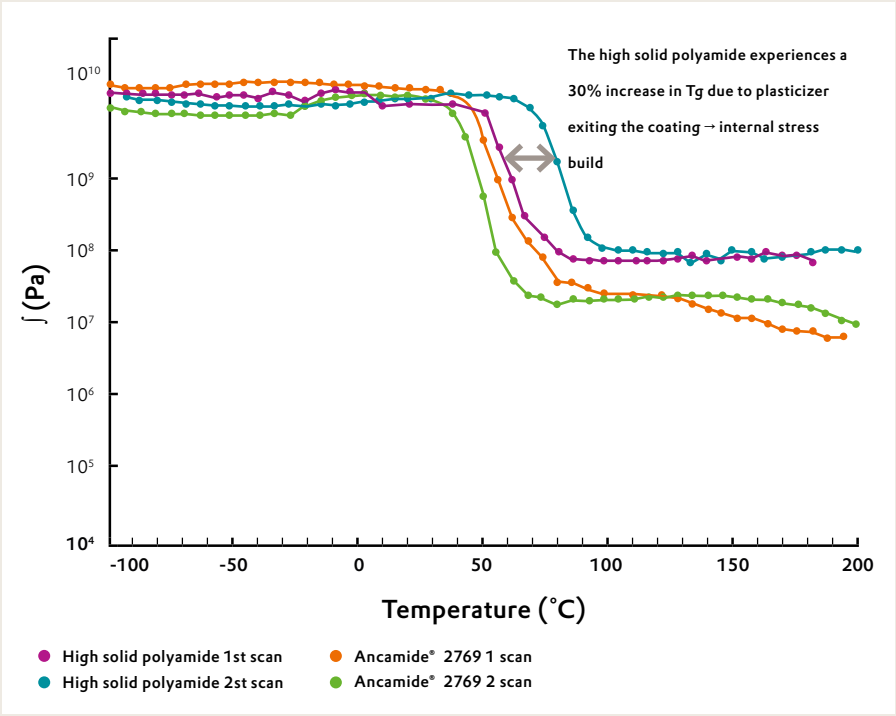

Table 1
Comparison of Ancamide® 2769 vs solvent based and conventional high solid curing agents.

Property	Unit	Ancamide® 2769	Solvent based polyamide	Conventional high solid polyamide
AHEW	g/eqv	150	270	150
Viscosity @25°C	mPa.s	100 – 150	2000 – 2500	2000 – 5000
Level of fugitive plasticizer	%	0	0	20 – 35
Level of solvent	%	0	30	0
Degree of cure, 7d @25°C	%	100	100	100
VOC for the curing agent only	g/L	0	282	306
VOC for curing agent plus epoxy resin	g/L	0[a]	480[b]	145[a]

[a] Formulated with liquid epoxy resin (EEW 190) [b] Formulated with solid epoxy resin (EEW 500)

For the second scans the coatings have been cured for 2 weeks at 25°C followed by 2 hrs at 150°C in an air circulation oven.

The glass transition temperature (Tg) of the coating based on conventional curing agent demonstrates a significant increase (ca. 60°C) between the initial and second scan. At the same time the initial effective molecular weight between crosslinks, Mc, of 1020 g/mol decreases to 930 g/mol. This behavior illustrates the potential shortfall of conventional epoxy systems. Non-reactive plasticizers are liberated from the coating with the consequent danger of stress accumulation.

In comparison the Ancamide® 2769 coating shows no such shortfall. The changes in Tg between initial and second scan are within error margins at a similar decrease of Mc.

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