

ERISYS™ GA-240 as a Replacement for Polyfunctional Aziridine Crosslinkers for Polyurethane Dispersions

Summary:

Evaluation of ERISYS GA-240 as a replacement for polyfunctional aziridine crosslinkers for polyurethane dispersions.

Background

Polyurethane dispersions are primarily acid functional resins neutralized with a tertiary amine to make stable water dispersions. As these resins are dried, the tertiary amine is liberated as the film dries resulting in a coalesced film with free acid groups. In many applications this is sufficient to provide tough durable coatings. However, in certain environments improved chemical resistance is required. A number of additives have been used to react with the free acid groups to achieve further crosslinking and thus further chemical resistance. Among these are polyfunctional aziridines, which are reported to react with the acid groups at room temperature.

In this study, a water-based polyurethane (Neo Rez R-960, supplied by Zeneca Resins) was selected for evaluating ERISYS GA-240 as a potential room temperature crosslinker. It was compared with the uncrosslinked resin and resin crosslinked with Zeneca's polyfunctional aziridine CX-100. Various concentrations of crosslinker in an air-dried system were evaluated for MEK rub resistance.

Experimental:

Components were easily combined in 4 oz. glass jars with hand stirring. Films were drawn down on 0.032" CRS panels using a No. 50 wire wound rod immediately after cessation of mixing each formulation. The films were allowed to cure for eleven days at R.T. and tested for resistance to double MEK rubs. The results of the testing are presented in the attached table.

Discussion of Results:

Both crosslinkers exhibited easy dispersibility in the PUD and both exhibited significant improvement over the uncrosslinked formulation. For the aziridine based compositions there is no significant difference between 1 and 3 parts of crosslinker with regard to MEK rub resistance even up to 300 double rubs. The films were softened with no noticeable loss of gloss. Precatalyzed formulations appeared to be stable at room temperature of up to 21 days.

Films crosslinked with ERISYS GA-240 the level of 1% showed some loss of gloss at 100 double rubs and loss of film properties at 200. Except for small loss in gloss at 2, 3 and 5% the performance of the crosslinker appeared to be comparable to aziridines with regard to the softening of the film. It was noted however, that at higher concentrations the reactivity to GA-240 was sufficient to cause the catalyzed PUD to gel after 11 days. At 300 double rubs edge lifting was noted on all formulations crosslinked with aziridines or ERISYS GA-240.

ERISYS™ GA-240 as a Replacement for Polyfunctional Aziridine Crosslinkers for Polyurethane Dispersions

FORMULATION, pbw

NEO REZ R-960
 Crosslinker CX-100
 ERISYS GA-240

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>
100----->							
--	1	2	3	--	--	--	--
--	--	--	--	1	2	3	5

RESULTS

After 11 days at R.T. on bench

70 double rubs
 100 double rubs
 200 double rubs
 300 double rubs

Softened (Loss of Gloss)	--	--	--	--	--	--	--
--	Softened (No loss of Gloss)	Softened (No loss of Gloss)	Softened (No loss of Gloss)	Softened (Loss of Gloss)	Softened (No loss of Gloss)	Softened (No loss of Gloss)	Softened (No loss of Gloss)
--	Softened (No loss of Gloss)	Softened (No loss of Gloss)	Softened (No loss of Gloss)	Film Destroyed	Softened (Loss of Gloss)	Softened (No loss of Gloss)	Softened (No loss of Gloss)
--	Softened (No loss of Gloss) Edge Lifting	Softened (No loss of Gloss) Edge Lifting	Softened (No loss of Gloss) Edge Lifting	--	--	Softened (Loss of Gloss) Edge Lifting	Softened (Loss of Gloss) Edge Lifting

VARNISH STABILITY AFTER:

11 days at R.T.
 21 days at R.T.

--	Liquid----->	Gelled----->
--	Liquid----->	Gelled -- --