

Epalloy™ 7200 as an Alternate to an Acrylate-Modified Epoxy Resin

Epoxy Resins are sometimes modified with acrylate monomers such as Trimethylolpropane Triacrylate (TMPTA) to help provide formulated adhesives, coatings, and patching compounds with rapid cure and/or the capability to cure at very low temperatures. The viscosity of some acrylated systems are quite low due to the diluting effect of the low viscosity acrylate modifier. While the viscosity of Epalloy 7200 would preclude its use in some very low viscosity formulations, it will be useful in some applications in place of acrylated epoxy, and will show marked advantages over the use of the acrylate-modified formulations.

Simple formulas were tested to compare the gel time, hardness development, chemical resistance, and Tg of an acrylated resin against an Epalloy 7200 resin cured with TETA. Formulations used in this study are shown below in **Table 1**. The 80/20 Epalloy 7200/GE-20 formula was chosen to provide a viscosity similar to the acrylate resin blend used.

Table 1 – Epalloy 7200 vs. Acrylated Resin		
<u>Formulation</u>	A	B
LER	75	0
Epalloy 7200	0	80
Acrylated Resin ¹	25	0
GE-20	0	20
TETA	14	13.4
Viscosity	5300	5200
¹ – Epon 8111		

Gel time was run on samples measuring 20 grams in mass and contained in a 2 inch diameter aluminum pan. Hardness development was tracked on these twenty gram samples by use of a Shore D hardness gauge. Samples for Tg were cut from these same 20 gram samples and run after 48 hour and 10 day room temperature cures. Similar discs were made for use in Xylene immersion testing. A # 50 wire-wound rod was used to make draw down samples of each formula on steel Q-panels for MEK rub testing, which was carried out after cure schedules of;

- 16 hours at RT
- 16 hours at RT + 2 hours at 100°C
- 4 days at RT

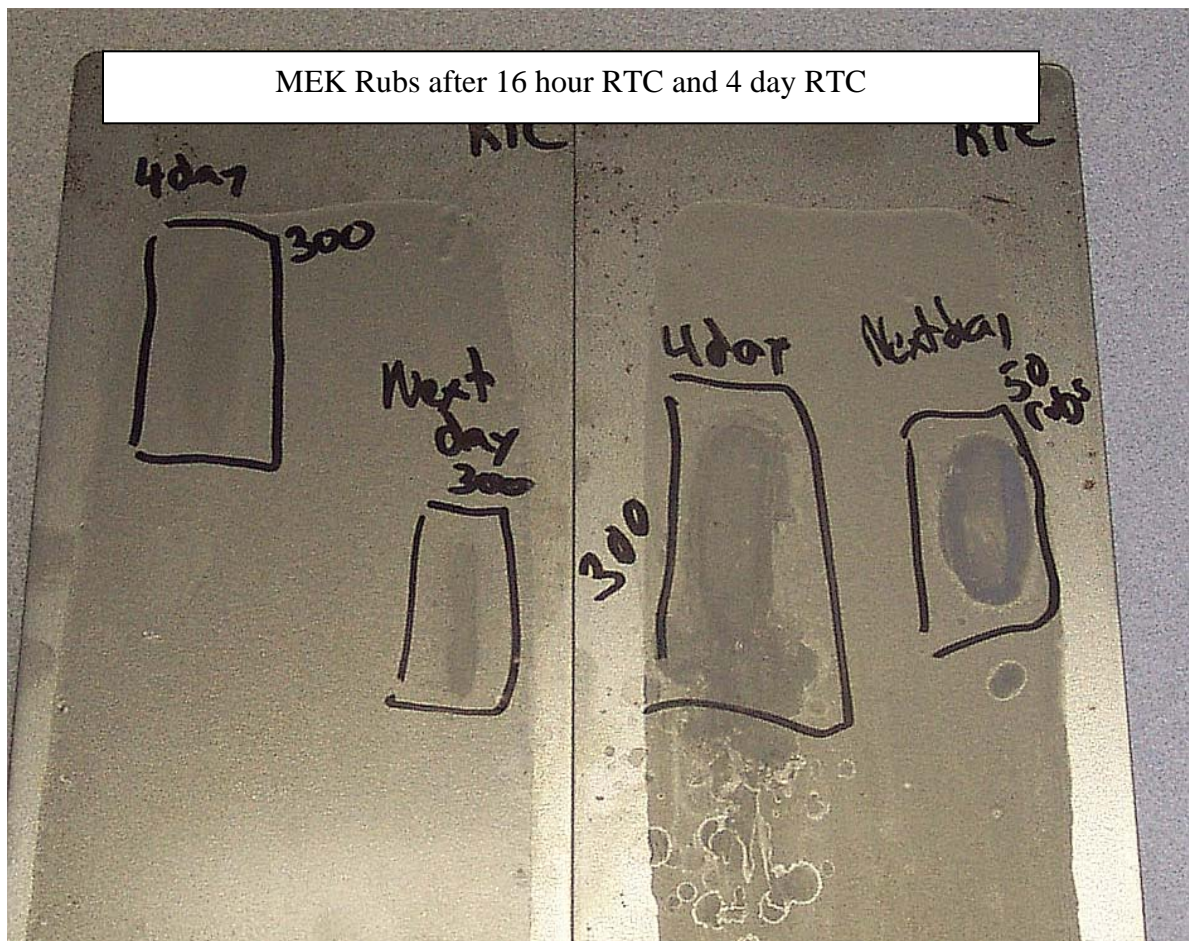
Table 2 summarizes the results of testing carried out on the two formulations.

Table 2 – Epalloy 7200 vs. Acrylated Resin		
<u>Formulation</u>	A	B
LER	75	0
Epalloy 7200	0	80
Acrylated Resin	25	0
GE-20	0	20
TETA	14	13.4
<u>Test Results</u>		
Gel Time (20 grams)	12"	11"
Hardness (hours to D=80+)	7	1
Tg (48 hour RTC)	51°C	70°C
Tg (10 day RTC)	53°C	80°C
MEK Rubs/Heat Cure ¹	>300	>300
MEK Rubs/16 hr. RTC	<50 ²	>300
MEK Rubs/4 day RTC	>300 ²	>300
Xylene Resistance/Heat Cure ¹	- 0.004% ³	+ 0.056% ³
Xylene Resistance/4-day RTC	+ 1.05% ³	+ 0.17% ³
¹ -16 hrs. RT + 2 hrs. @ 100°C; ² -Stained film appearance;		
³ - 3 days immersion;		

The results show the use of Epalloy 7200 resin yields;

- Similar gel time to the control but much faster development of cured properties as indicated by hardness development.
- Significantly higher Tg with room temperature cure. This is because the Epalloy 7200 is fully reactive, unlike the acrylate modifier, which acts to plasticize the cure resin compositions and thereby reduce thermal performance.
- Improved chemical-resistance in ambient temperature cured samples, as indicated with MEK rub resistance and Xylene immersion testing.

The photograph below shows panels used for MEK rub resistance on room temperature cured films. Rub testing was performed after cures of 16 hours at RT, and 4 days at RT. The acrylate resin modified film did not perform well after either cure cycle. At 16 hours the film became very gummy with initial MEK rubs, and was stained afterwards wherever MEK was in contact with the film. After 4 days the rub resistance improved, but the film still stained badly. Panels that were heat cured performed well. The Epalloy 7200 films showed much improved performance over the acrylated system with improved rub resistance and no staining as shown in photos.



Epalloy 7200/NPGDGE @
80/20 cured w/TETA

LER/Acrylated Epoxy @
75/25 cured w/ TETA

Epalloy 7200 can be used in lieu of acrylate modifiers to provide fast cure epoxy resin formulations for coatings and adhesive applications. Some of the advantages to the use of the Epalloy 7200 include faster through cure, higher thermal resistance and improved chemical resistance.

The next article in this series will look how Epalloy 7200 can be used to help reduce water spotting in clear coating formulations.

If you would like to discuss the use of Epalloy 7200 in your formulation, please call Charles Zarnitz, Technical Service Manager - Epoxies, at 856-533-3022 or send an e-mail to charles.zarnitz@emeraldmaterials.com.

If you would like a sample of Epalloy 7200 to try in your formulation, please call CVC Thermoset Specialties at 856-533-3000 or place a sample request through our website at www.cvc.emeraldmaterials.com.