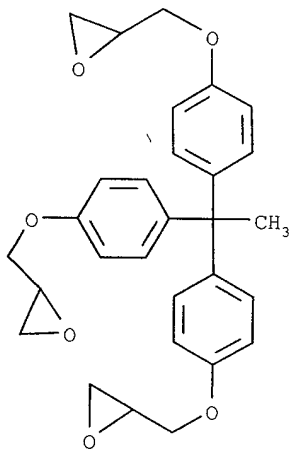


**Epalloy 9000 vs. Competitive Multifunctional Resins for Increased Tg****Objective**

To show the relative effect on Viscosity and Tg when using Epalloy 9000 as a modifier for standard liquid epoxy resin as compared to competitive high performance multifunctional resins Epon SU-8 and Tactix 742.

**Description**

Epalloy 9000 is described as tris-Hydroxy Phenyl Ethane Triglycidyl Ether. Structure is shown below.



Structure of Epalloy 9000 (THPE-GE)  
1,1,1-tris-(p-Hydroxyphenyl)ethane Glycidyl Ether

As a trifunctional resin with high aromatic character Epalloy 9000 would be expected to provide cured systems with very high Tg. When used neat and cured with NMA (Nadic Methyl Anhydride) Tg's as high as 280°C can be achieved.

However, Epalloy 9000 can also be used as a modifier in standard LER for increased Tg. Competitive products like Epon SU-8 and Tactix 742 can, and are used in like manner. The purpose of this TSR is to report on our comparisons of these three materials for effect on viscosity and Tg when used as a modifier for standard LER.

**Results**

Mixtures were made at 10, 20, 30, and 40% levels of modification in Epalloy 7190 (Standard LER) using Epalloy 9000, Epon SU-8, and Tactix 742 as modifiers. Viscosity was measured on each mixture and cured samples were made to test Tg. PACM from Air Products was used as the curing agent and Tg was measured after a cure schedule of overnight at RT + 3 hours at 178°C + 1 heat scan to 250°C. All results are shown below in Table 1.

**Epalloy 9000 vs. Competitive Multifunctional Resins for Increased Tg**

**Table 1 – Modifier Level vs. Viscosity and Tg**

**Epalloy 9000 v. SU-8 and Tactix 742 - Modifier level vs. Viscosity and Tg with PACM (2)**

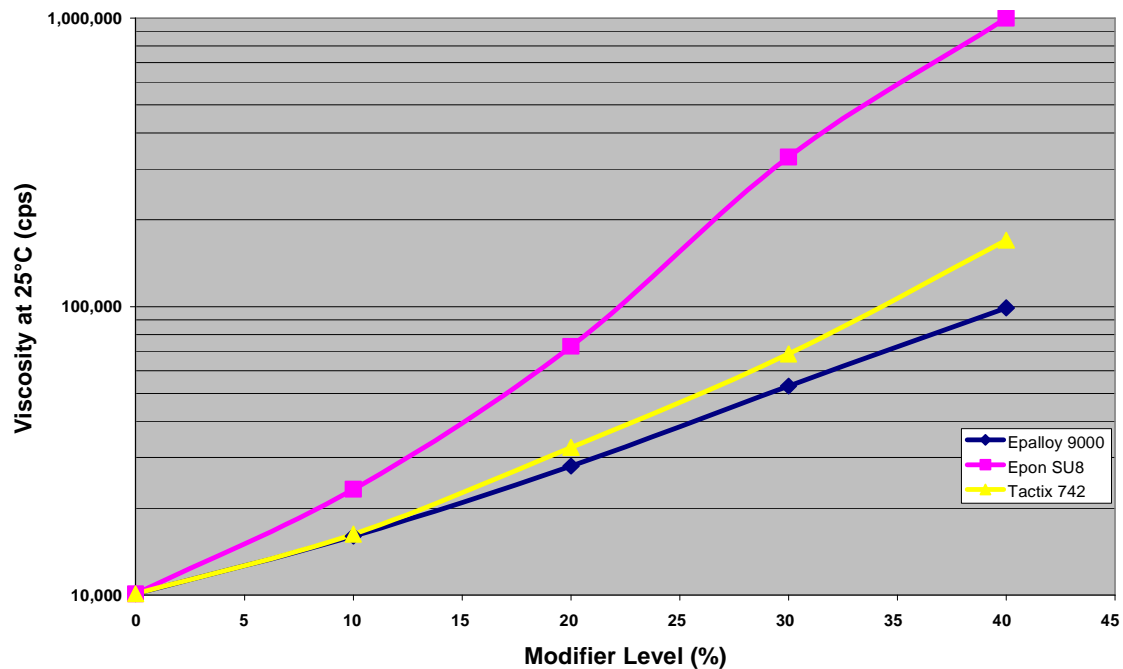
Epalloy 7190 Modifier	50 0	90 10	80 20	70 30	60 40
<u>Viscosity at 25°C (cps)</u>					
Epalloy 9000	10,100	16,000	28,000	53,000	99,000
Epon SU-8	10,100	23,250	72,800	330,000	1,000,000
Tactix 742	10,100	16,250	32,500	68,500	170,000
<u>Tg (°C)*</u>					
Epalloy 9000	163	166	182	203	n.a
Epon SU-8	163	171	179	186	193
Tactix 742	163	169	176	189	n.a.

\* Cured with PACM - overnight at RT + 3 hours at 178°C

The following figures will help to illustrate these results;

**Figure 1 – Modifier Level vs. Viscosity**

**Epalloy 9000 v. Epon SU-8 and Tactix 742 - % Modifier Level in LER v. Viscosity**



**Epalloy 9000 vs. Competitive Multifunctional Resins for Increased Tg**

Figure 2 – Modifier Level vs. Tg

Epalloy 9000 v. Epon SU8 and Tactix 742 -- % Modifier Level in LER v. Tg (PACM Cure)

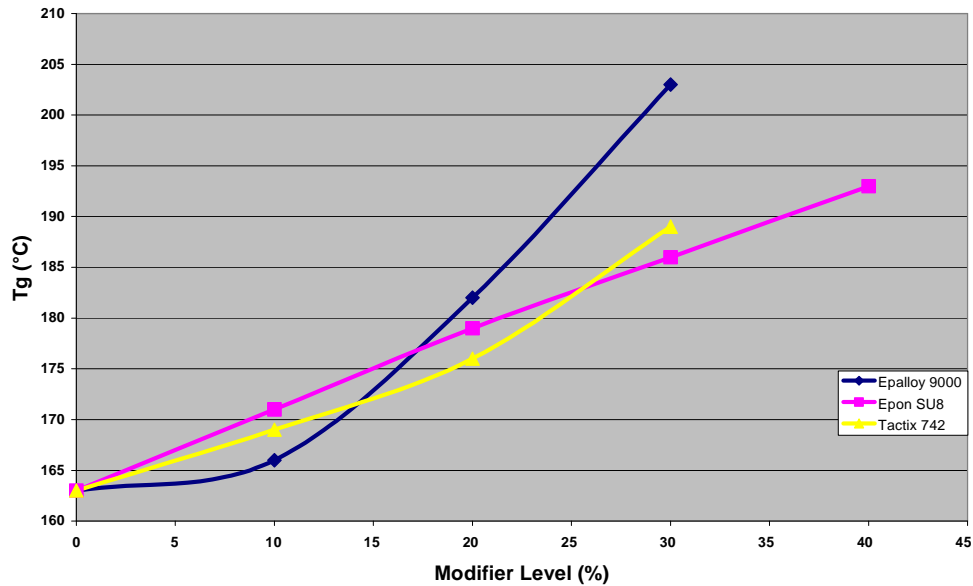
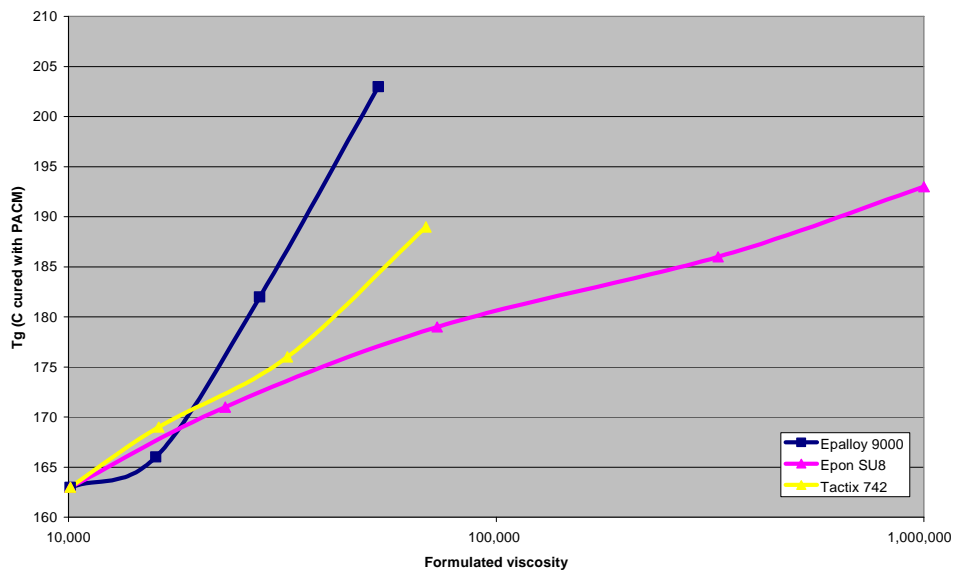


Figure 3 – Tg vs. Viscosity

Affect on Tg as function of formulated Viscosity



**Conclusions**

These data clearly indicate the trend that Epalloy 9000, when used as a modifier for standard LER will provide formulated systems with lower viscosity and higher Tg as compared with other high performance multifunctional resins.