

# D180 DILUENT IN EPOXY FORMULATIONS

## DESCRIPTION

The D180 are useful solvents in a variety of applications. At room temperature D180 is a solid, while D180 is liquid. These solvents possess low toxicity, high polarity, and relatively low vapour pressure and are miscible with many other solvents. Some materials which dissolve in few if any other solvents will dissolve in the D180. They can be used as reactants as well as solvents. Because of their reactivity and the dilution effect, the D180 have a considerable effect on the behavior of certain amine-cured epoxy resin systems.

## FEATURES

The effects of the D180 in the epoxy formulation will depend on the D180 concentration and on the reactivity of the amine curing agent. With relatively reactive unhindered aliphatic amine curing agents such as ethyleneamines and polyoxyalkyleneamines the effects are more significant. In general the following features are noted:

- Lower viscosity
- Shorter gel time
- Improved cured resin properties
- Greater elongation

## BENEFITS

The D180-modified epoxy systems are good candidates for use in any application where reactive curing agents are used and where reduced viscosity, faster cure, and improved strength and modulus would be desirable. Suggested applications would include flooring, potting, and coatings. The reduced viscosities that are possible can be useful in formulating highly filled systems that retain good mechanical properties.

## DISCUSSION

Addition of D180 results in a decrease in resin viscosity. The 10,000-12,000 cP viscosity of the typical liquid epoxy resin can be reduced to around 1,000 cP by addition of 20 phr of a D180 (Figure 1). Although the D180 is thus not as effective in viscosity reduction as conventional glycidyl ether diluents, in some cases (with reactive amines) they enhance the formulation properties in other ways besides viscosity reduction. Table(1) shows comparisons of some ambient cure and heat cure data.

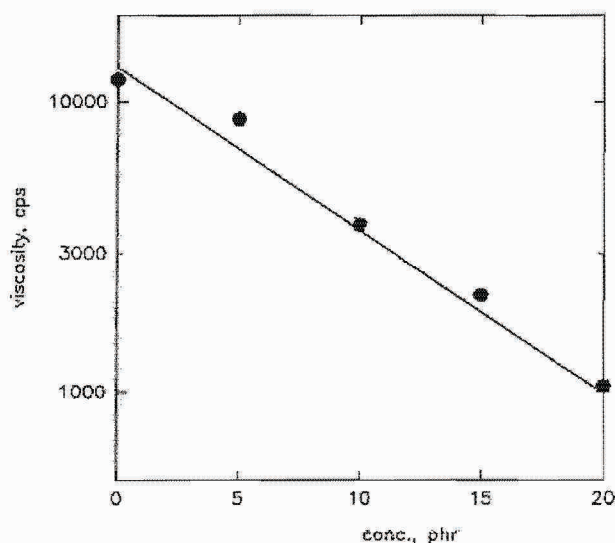


Figure 1

The focus in the table is on cures with relatively reactive amines, because they are representative of the curing agents which give enhanced properties in the D180 -diluted systems.

Unlike other reactive diluents, the D180 (used with the more reactive curing agents) give a reduction in the gel time that is roughly proportional to their concentration, at least up through about 20 phr. his decrease in gel time is accompanied by little if any change in the exotherm temperature. The typical polyoxyalkyleneamines gel time of about 70 minutes, for example, can be reduced to 20 minutes or less with

The consumption of some amine through reaction with the D180 results in some increase in the mix ratio that gives the optimum glass transition temperature.

In general the strength, modulus and elongation values with either room temperature or elevated temperature cures are increased by the presence of low levels of the D180. In a room temperature cure, better properties are attained in a given period of time. Thermal properties and solvent resistance, on the other hand, are reduced somewhat.

Density, lb/gal	10.02
Boiling point, °C	242
Freezing point, °C	
Flash point, PMCC, °F	275

Table 1. Cured Resin Properties with D180

Ambient Cure vs. Heat Cure

Liquid epoxy resin, e.e.w. 188	100	100	100	100	100	100	100
DETA	21	21					
TETA			13	20	20		
TEPA						20	20
D180	10	10		10	10	10	10
cure conditions	heat	rt	rt	heat	rt	heat	rt
Tensile strength, psi	13,700	5,250	2,100	12,500	8,300	9,000	8,900
Tensile modulus, psi	615,000	599,000	640,000	565,000	581,000	541,000	554,000
Ultimate elongation, %	6.4	0.95	0.4	3.8	1.6	2.1	1.9
Flexural strength, psi	23,600	9,700	4,900	22,600	16,800	21,800	15,800
Flexural modulus, psi	555,000	541,000	470,000	521,000	550,000	509,000	547,000
HDT, °C, 264 psi	68	51	51	86	54	89	50
%Wt. gain, 24 hr water boil	9.3	9.8	1.8	5.4	5.4	4.4	4.5
%Wt. gain, 3hr acetone boil	4.9	8.5	0.3	1.6	8.3	0.92	8.4

Cure conditions: **heat**: 2 hr 78°C, 3 hr 130°C; **rt**: 7days approx. 25°C

#### **Typical Physical Properties**

EEW	100
Ash, wt.	% < 0.01
Autoignition temperature, °C (°F)	432 (810)
Boiling point, °C (°F)	240 (464)
Dielectric constant, esu, 25°C	65
Flash point, PMCC, °C (°F)	137 (278)
LEL, (v/v) at 200°C,	% 4.7
Melting point, °C (°F)	-49 (-56)
pH	7
Specific gravity, 20/20°C	1.2

Specific resistance, ohm-cm 25°C	1-8x10 <sup>6</sup>
UEL, (v/v) at 200°C,	% 21
Vapor pressure, mm Hg, 20°C (68°F)	0.02
Viscosity, Kinematic, cSt, 43.3 °C (110°F)	1.6
VOC Content by ASTM D2369	VOC Exempt
Water Solubility (%)	1-10
Weight, lb/gal, 20°C	10.1