

## Technical Data

# MPDiol® Glycol

## Synthesis of a Terephthalate Unsaturated Polyester Resin (UPR)

### First Stage Charge

Terephthalic acid (TPA)	332g	2 moles
2-methyl-1,3-propanediol (MPDiol® glycol)	360g	4 moles
Catalyst (Fascat 9100*)	0.1 g	150 ppm

\*product of Atofina Company

### Second Stage Charge

Maleic anhydride (MA)	294 g	3 moles
Propylene glycol (PG)	95 g	1.25 moles

### Reactor

Two liter resin reactor, heating mantle, temperature controller, mechanical agitation, steam heated reflux condenser, nitrogen bubbling.

### Procedure

#### First Stage:

1. Add MPDiol glycol, TPA and catalyst to the reactor.
2. Heat at 205°C for 10 hours (until equivalent amount of water is collected).
3. Cool mixture to about 120°C.

#### Second Stage:

4. Add MA & PG.
5. Heat at 200°C for about 12 hours (collect approximately 50 ml. of water) until the final acid number has reached 20.
6. Add 150 mg of inhibitor (hydroquinone).
7. Cool to 140°C.
8. Discharge and blend the resin with 600 g of cold styrene containing about 150 mg of butyl hydroquinone.

PROPERTY	TEREPHTHALATE*	TEREPHTHALATE
<i>TPA/MA/MPD/PG</i>	<b>0.8/1.2/1.6/0.5</b>	<b>1.0/1.0/1.6/0.5</b>
Tensile Strength (MPa) (kpsi)	64 9.5	89 12.5
Tensile Modulus (MPa) (kpsi)	3240 470	3790 550
Tensile Elongation (%)	3.7	4.0
Flexural Strength (MPa) (kpsi)	132 19	152 22
Flexural Modulus (MPa) (kpsi)	3310 480	3860 560
HDT (°C) (°F)	120 248	99 210
Water boil (% retention)	93	68
KOH boil (% retention)	93	93
HCl boil (% retention)	85	79
Viscosity at 45% styrene (cP)	650	500

\*Material described in reaction procedure

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### Procedure for UPR Casting and Corrosion Testing

The resins were cured with 1% LUPEROX DDM-9 peroxide (MEKP, methyl ethyl ketone peroxide) a product of Atofina Chemicals, Inc., and 0.2% Cobalt Naphthenate (6% CoNap solution in mineral spirits) overnight under ambient conditions, followed by a postcure for 5 hours at 100°C. The physical properties of the cured thermosetting polymers were determined using ASTM test methods. Tensile strength, modulus and elongation are determined using ASTM D-638, Type 1. Flexural strength and flexural modulus: ASTM D-790. DTUL: ASTM D-648. Short-term environmental testing was performed by placing flexural test specimens in a sealed tube with the indicated solvent for one week at 100°C. Following the high temperature exposure, the samples were removed and flexural tests were run to determine the percentage of initial flexural strength the sample retained.

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