

## Technical Data

# MPDiol® Glycol

## Synthesis of an Unsaturated Polyester Resin (UPR) From PET

<b>First Stage Charge</b>	Polyethylene terephthalate (PET)	576 g	3.0 moles
	2-Methyl-1,3-propanediol (MPDiol )	270 g	3.0 moles
	Zinc acetate [Zn(OAc) <sub>2</sub> ]	0.2 g	150 ppm
<b>Second Stage Charge</b>	Maleic anhydride (MA)	441 g	4.5 moles
	Propylene glycol (PG)	144 g	1.9 moles
<b>Reactor</b>	Two liter resin reactor, heating mantle, temperature controller, mechanical agitation, steam heated reflux condenser, nitrogen bubbling.		

### Procedure

#### First Stage:

1. Add MPDiol glycol, PET, and zinc acetate to the reactor.
2. Heat at 205-210°C for 6 hours.
3. Cool mixture to about 100°C.

#### Second Stage:

4. Add MA & PG.
5. Install a steam condenser on reactor and heat at 205-210°C for 8-10 hours (collect approximately 50 ml. of water).
6. Final acid number should be approximately 20.
7. Add 150 mg of hydroquinone.
8. Cool to 140°C.
9. Blend the resin with 750 g of cold styrene containing about 150 mg of butyl hydroquinone.

PROPERTY	PET-MPD	Terephthalate-MPD*
<i>TPA/MA/MPD/EG/PG</i>	<b>0.8/1.2/0.8/0.8/0.5</b>	<b>0.8/1.2/1.6/--/0.5</b>
Tensile Strength (MPa) (kpsi)	74 10.7	64 9.3
Tensile Modulus (MPa) (kpsi)	3275 475	3240 470
Tensile Elongation (%)	2.9	3.7
Flexural Strength (MPa) (kpsi)	145 21	132 19
Flexural Modulus (MPa) (kpsi)	3585 520	3310 480
HDT (°C) (°F)	117 242	120 248
Water boil (% retention)	73	93
KOH boil (% retention)	12	93
HCl boil (% retention)	67	85
Viscosity at 45% styrene (cP)	250	650

\*See the synthesis of terephthalate resins from TPA.

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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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