

Understanding High Temperature Resins

ProPolymers

High Temperature Resins



Overview

- About Pro Polymers
- Comparison of temperature resistance
- Detailed look at PPS, PPE, PEI, PSU, LCP, PPA, PA 4,6, PET, PBT
- Comparison of properties

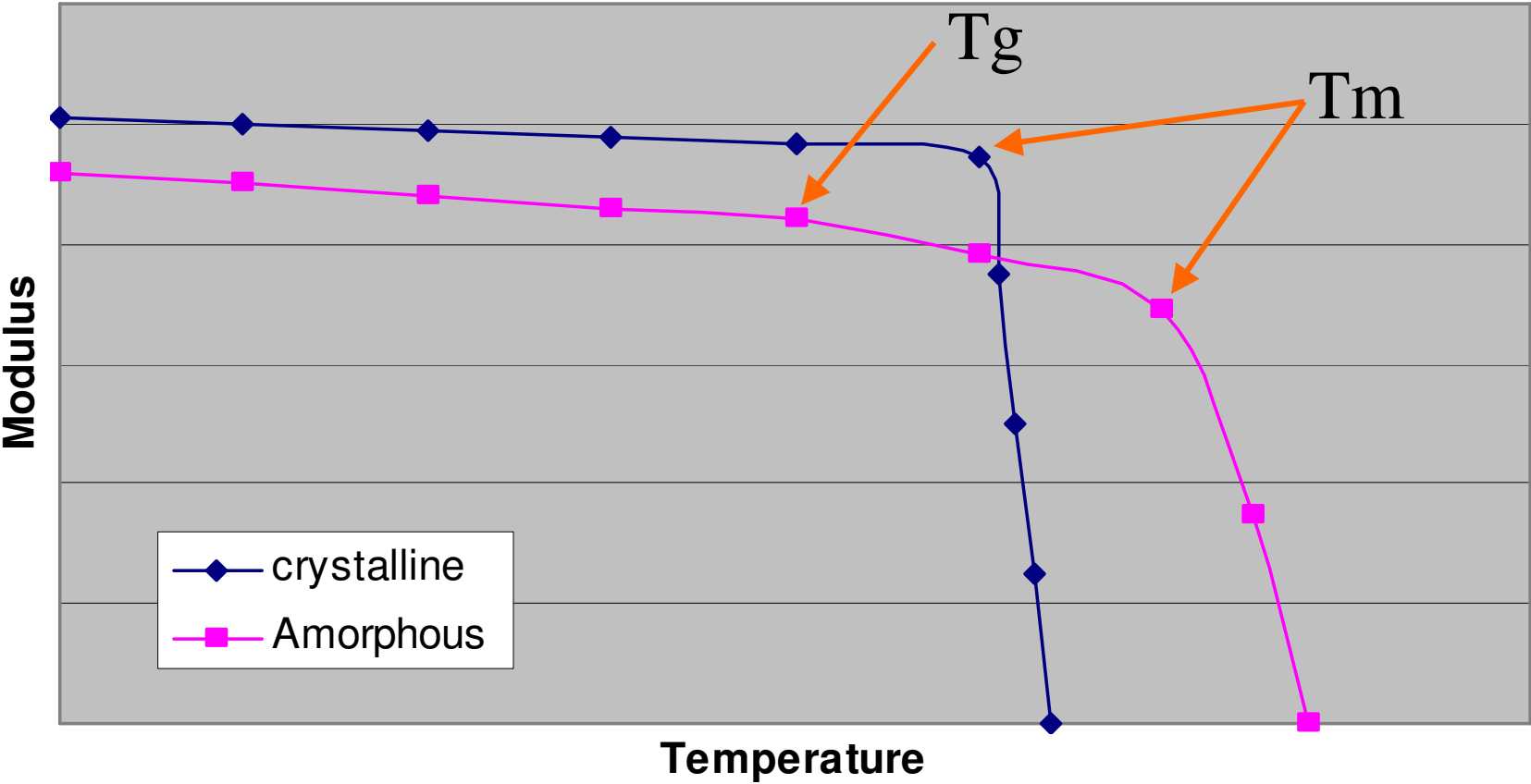
Pro Polymers Overview

- Located in Stockbridge, MI near Ann Arbor
- We only compound high temperature resins
- Twin screw compounding lines are set up with water slide pelletizers and other modifications.
- Complete lab ability to do chemical resistance testing
- Can sample tools

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High Temperature Resins

Amorphous vs. Crystalline



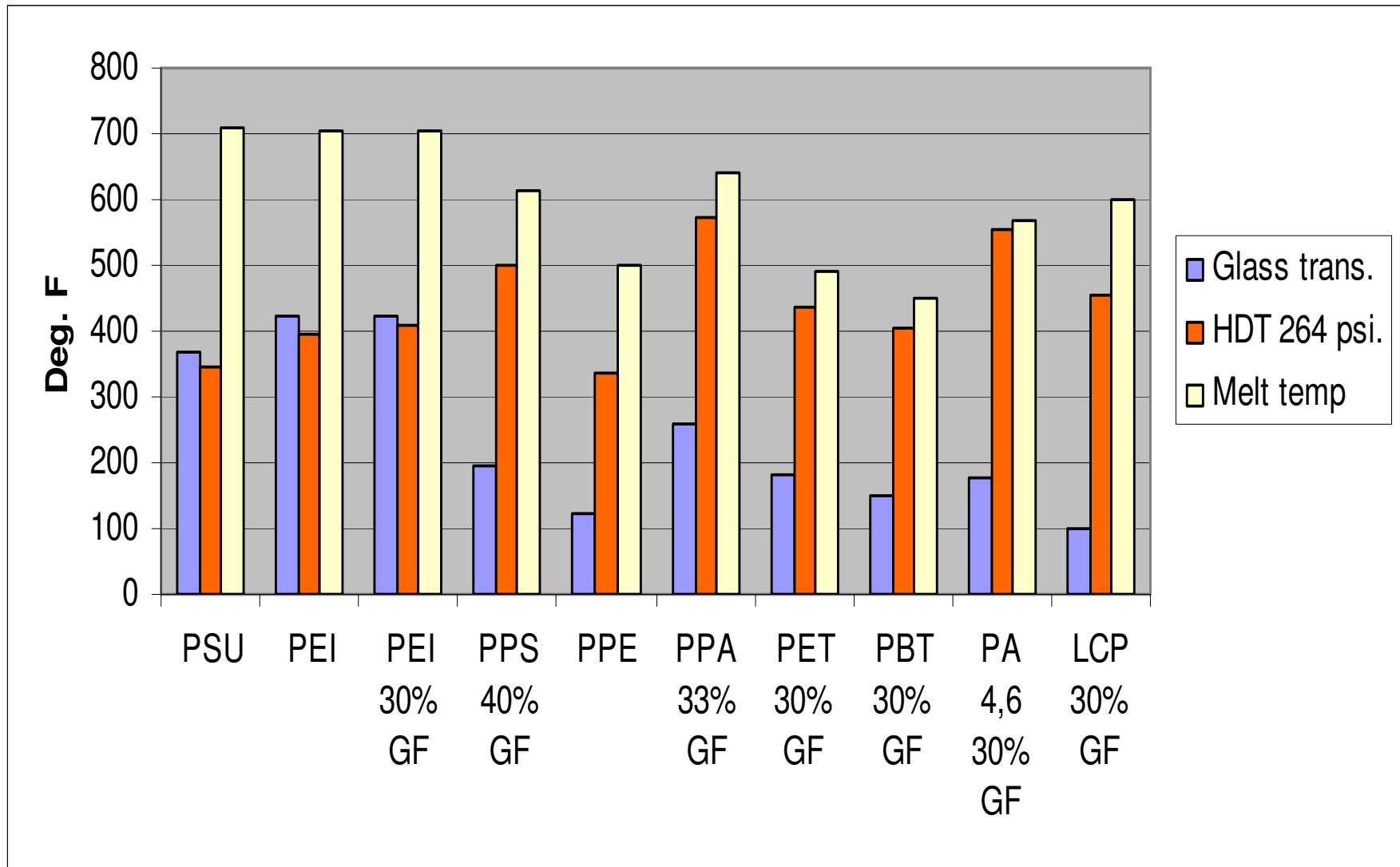
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Test Methods

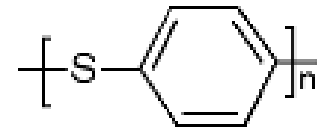
- Melt Temperature
 - Thermodynamic
 - Processing
- Glass Transition Temperature
 - Temperature at which a polymer changes from hard and brittle to soft and pliable
- Relative Temperature Index UL 746B
 - Long term temperature at which <50% of properties are lost.
 - Elec., Mechanical, and Impact
- Thermal Deflection Temp.- Heat Distortion Temp.
 - ASTM D648 66 or 264psi, Temp at which a Flexural bar deflects under a given load.

Heat Resistance



PPS - Polyphenylene Sulfide

- 500F HDT. \$3-4/lb
- Available in linear and branched
- Excellent flow – flashing problems
- Stiff, can be 40-70% reinforced, Brittle
- Applications
 - Fluid Handling
 - Electronic chassis



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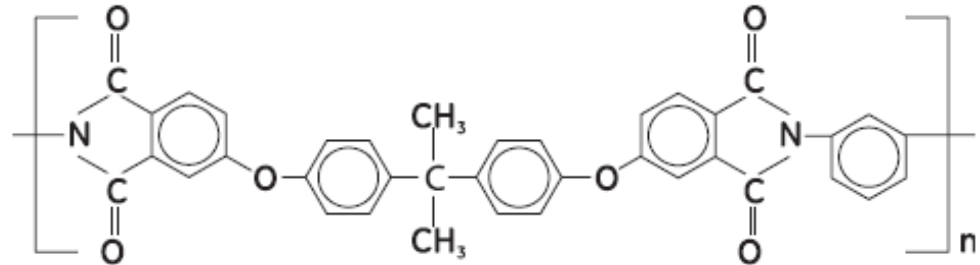
High Temperature Resins

PPO/PPE -Polyphenyl ether

- Amorphous \$2-3/lb
- Excellent resistance to acid and base, poor to oils
- Easy to process, water cooled tools,
- Good dimensional stability, low warpage
- Poor UV resistance, yellows quickly
- Typical applications
 - Electronic chassis
 - Water handling

PEI - Polyetherimide - Ultem®

- HDT 390-410F
- \$6-9/lb
- Amorphous resin with good gloss and toughness.
- Requires oil heated tools and melt temp of 700F
- Can be difficult to flow and can have poor knit line strength
- Inherent flame retardence and good chemical resistance.
- Applications
 - Head lamp reflectors
 - Heated food containers and trays
 - Aircraft interiors



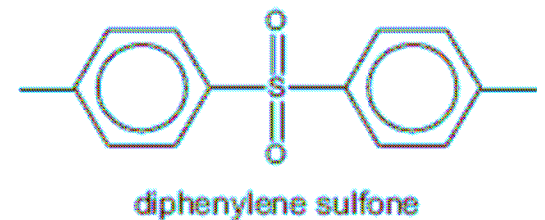
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High Temperature Resins

Ultem is a trademark of Sabic

PSU - Polysulphone

- Amorphous, 345 F HDT \$6-9/lb
- Best chemical resistance
- Applications
 - Plumbing connectors and fittings
 - Medical devices requiring steam sterilization



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High Temperature Resins



Liquid Crystal Polymer

- Type of polyester typically based on hydroxy benzoic acid Crystalline \$5-10/lb
- Combines excellent flow with low shrinkage and low flash.
- Can produce small intricate parts with varying wall thickness.
- Applications
 - Electrical connectors



PPA - Polyphthalamide - Amodel®

- PA 6T variations
- Improve on the high temperature resistance of PA6,6 with lower water absorption.
- Good value \$2.50-3.50/lb.
- Excellent resistance to oil based chemicals but limited resistance to acid,bases and steam
- Applications
- Under hood fuel rails and components
 - Electrical parts from connectors to high voltage

PA 4,6

- High flow and great toughness
- Very high water absorption 8%
- Price \$2.5-4.5/lb
- Applications
 - Connectors
 - Conveyers and wear components

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High Temperature Resins



PET and PBT

- Both polyesters are cost competitive \$1.50-2.00/lb
- PET has slightly higher heat resistance but end properties are affected by processing conditions.
- PBT is a good general purpose material
- Applications
 - Electrical components A-Z
 - General mechanical parts

Chemical resistance

We can test multiple polymers for resistance to your specific environment.

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