Material Characterization in PPI

1. Thermal and Thermomechanical Characterization
2. Rheological Characterization
3. Mechanical Characterization
4. Chemical Characterization
5. Structural Characterization
6. Particle and Particle Size Analysis
7. Other Characterization

THERMAL CHARACTERIZATION

Differential Scanning Calorimeter

- Perkin-Elmer DSC-8000
- Heat of fusion, heat of crystallization and glass transition of polymers
- Specific heat of polymers
- Heat of curing of thermosetting polymers
- Kinetic of reaction
- Temperature range -80 to 400°C
- Gas switching capability

Thermogravimetric Analyzer

- Perkin-Elmer TGA-8000
- Degradation of polymer
- Kinetic of reaction
- Gas switching capability
- Temperature Range 25 to 1000°C

Thermomechanical Characterization

- Rheometric Scientific DMTA IV
- Film, fiber, foam, solid, gel, composite
- 6 different fixtures: single cantilever, dual cantilever, three point bending, compression, tension and shear sandwich
- Temperature range from –140°C to 400°C
- 5 decades range of frequency
- Dynamic properties of polymer such as linear viscoelastic region, elastic (E') and viscous (E") modulus and tan δ as a function of frequency, time and amplitude

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- Glass transition of solid polymer, polymer blend, filled polymer or rubber
- Time Temperature Superposition
- Creep and recovery
- Strain Rate Test

RHEOLOGICAL CHARACTERIZATION

Capillary Rheometer

- Instron Capillary Rheometer (Floor Model # 4204)
- Moderate to high shear rates with or without entrance pressure correction as per ASTM D-3835
- Most commercial polymer, filled and unfilled
- Melt Adhesives
- Rate of degradation at high temperatures
- Melt Strength measurement
- Melt Density
- Temperature Range: 25 to 400°C

Oscillatory Rheometer

- Polymer solutions, melt polymer, thermosetting polymer, hot melt adhesives, rubber and solid polymer
- Dynamic properties of polymer such as linear viscoelastic region, complex viscosity (□*), elastic (G') and viscous (G") modulus and tan δ as a function of frequency, time and amplitude as per ASTM D-4440
- Time-Temperature-Superposition (TTS)
- Steady shear viscosity for melt polymer or hot melt adhesives from low to moderate shear rates
- Hysteretic study for melt adhesives or silicone based material
- Transient properties of polymer such thixotropic or stress relaxation
- Curing study such as the onset of curing, gel time and cross-linked viscosity of thermosetting polymer
- Glass transition of solid polymer, polymer blend, filled polymer or rubber
- Advanced analysis for transformation, fitting for viscosity model and Molecular Weight Analysis
- Temperature Range: -140 to 400°C

Elongational Rheometer

- Rheometric Scientific RMS-800 as host
- SER-HV-R01 from Xpansion Instruments, LLC

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- 2 - 2000 g.cm torque limit
- Forced convection oven.
- Nitrogen environment with temperature range: 0-250°C
- Samples molded with natural cooling
- Maximum Hencky Strain Rate: 20/s
- Sample Size: width: 15-18 mm and thickness: 0.2 – 0.8 mm
- Sample length range: 18-20 mm

MECHANICAL CHARACTERIZATION

- Instron Mechanical Tester Model 5967 Dual Column Table Top
- **ASTM D-638** at 25°C (molded dog-bone samples)
    - Tensile strength at Yield
    - Tensile strength at Break
    - Elongation at Yield
    - Elongation at Break with Tensile Modulus
- **ASTM D-882** at 25°C for film samples
    - Tensile strength at Yield
    - Tensile strength at Break
    - Elongation at Yield
    - Elongation at Break with Tensile Modulus
- **ASTM D-790** (Flexural Properties)
- **ASTM D-1621** (Compression properties)

CHEMICAL CHARACTERIZATION

- HPLC – UV
- FTIR – Microscope
- Raman – Microscope
- UV-Vis Spectroscopy
- Gas Chromatography (Purge and Trap, Static Headspace / Pyrolysis)
- TOC Analyzer
- End-group Analysis (Carboxylic (PET, PBT), Acid Value (MA grafted PE, PP or Rubbers))

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Polymer Processing Institute

STRUCTURAL CHARACTERIZATION

- Atomic Force Microscopy
- Scanning Electron Microscopy (Cryo)
- X-Ray Diffraction
- Micro-CT Scanning

PARTICLE and PARTICLE SIZE ANALYSIS

- Mastersizer 3000
- Zetasizer Nano NS
- Dynamic Light Scattering
- BET Surface Area and Pore Size Analyzer

OTHER CHARACTERIZATION

- Dissolution system
- Molecular Weight Determination by Dilute Solution Viscosity

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