Thermal Analysis Capabilities

The Thermal Analysis Laboratory of ICSET at Western Kentucky University was established in 1987 and has evolved into one of the best, if not the best, equipped thermal analysis laboratories in the United States, which is capable of conducting:

High-Resolution / Modulated Thermogravimetric Analysis (TGA)
Material composition, thermal stability, sorption analysis and related phenomena

Micro-Thermal Analysis (µ-TA)
Surface visualization, surface characterization, spatial distribution of phases, thermal properties of small samples/small areas

Modulated and Pressurized Differential Scanning Calorimetry (MDSC and PDSC)
Simultaneous measurement of heat flows and temperature associated with transitions

Evolved Gas Analysis Systems (TGA-FTIR, TGA-MS)
Identification of gases evolved during weight loss via FTIR or mass spectrometers

Dynamic Mechanical Analysis (DMA)
Viscoelastic and rheological properties of material under an applied oscillating force

Thermomechanical Analysis (TMA)
Dimensional changes

Dielectric Analysis (DETA)
Capacitive and conductive nature of materials under acyclic voltage

Rheology

Deformation and flow of materials under force

Thermal analysis and rheological techniques are particularly useful for determining (ASTM standards),

- Composition of multi-component systems (E-1131)
- Thermal and oxidative stability of materials (E-1858)
- Transition temperatures (D-3418)
- Estimated lifetime of products
- Decomposition kinetics of materials (E-1641)
- Moisture and volatile contents of materials
- Permittivity and loss factor
- Glass transition temperature (E-1356, E-1640, E-1824)
- Degree and rate of cure
- Coefficient of thermal expansion (E-831)
- Specific heat, heat capacity (E-1269), thermal conductivity (E-1952), vapor pressure (E-1782)
- Modulus, viscosity, and polymer morphology

Thermal analysis and rheological techniques can be applied:

For Research and Development

- Formulation optimization
- Materials selection
- Application development
- End-use performance prediction
- Competitive product evaluation
- Theoretical research on new materials and processes

For Quality Assurance and Quality Control:

- Vendor certification
- Incoming/outgoing material consistency
- Process optimization
- Finished product performance