Material Testing Services

Hawk offers state-of-the-art equipment for your analysis needs. Specific instrumental analysis capabilities and potential applications are as follows:

**Material Identification:**

- **FT-IR analysis**
  Bulk material identification (organic & inorganic)

- **NMR analysis**
  More in-depth identification (mainly organic)

- **Mass Spectroscopy (MS)**
  More in-depth identification (organic)

- **Pyrolysis/MS**
  Identification of all organic components

- **Energy Dispersive Spectroscopy (EDS) - (elemental only)**
  Detects Na+ through upper elementals

- **ESCA - (elemental only)**
  Detects Carbon through upper elementals
Material Quantitation or Qualification:

- **Relative Molecular Weights of Polymers - Refractive Index Detection (RI)**
  - **Gel Permeation Chromatography (GPC - Non-aqueous)**
    Molecular determinations for Mn, Mw, Mz and Polydispersity using RI detection and a typical organic mobile phase (THF, CHCl₃, DMF and Toluene)
  - **Gel Permeation Chromatography (GPC - Aqueous)**
    Molecular weight determinations for Mn, Mw, Mz and Polydispersity using Refractive Index detection and water or a typical buffer as the mobile phase

- **Absolute Molecular Weights of Polymers - Light Scattering (LS)**
  - **Gel Permeation Chromatography (GPC - Non-aqueous)**
    Molecular determinations for Mn, Mw, Mz and Polydispersity using LS and RI detection and a typical organic mobile phase (THF or CHCl₃)
  - **Gel Permeation Chromatography (GPC - Aqueous)**
    Molecular determinations for Mn, Mw, Mz and Polydispersity using LS and RI detection and water or a typical buffer as the mobile phase

- **Polymer Solution/Mobile Phase dn/dc Determination via Light Scattering**

- **Additional General Chromatographic Assay Methods**
  - Reverse and normal phase liquid chromatography
  - Ion exchange liquid chromatography for elemental ions
  - Gas Chromatography

- **Spark Source Mass Spectroscopic Analysis (SSMS)**
  Complete elemental scan of all elements

- **Elemental Analysis - Coulemetric**
  - Carbon, Hydrogen, and Nitrogen
  - Carbon, Hydrogen, Nitrogen, and Oxygen
  - Carbon, Hydrogen, Nitrogen, Oxygen, and Sulfur

- **Inductively Coupled Plasma Emission and/or Atomic Absorption**
  Absolute concentrations of all elementals measured

- **Liquid Chromatographic/Mass Spectroscopic Analysis (LC/MS)**
  Partitioning and quantifying trace and major organic components
• **Gas Chromatographic/Mass Spectroscopic Analysis (GC/MS)**
  Partitioning and quantifying trace and major volatile organic components

• **Thin Layer Chromatographic Analysis (TLC)**
  Partitioning and quantifying trace and major organic components via UV Illumination or chemical spray

• **Electrophoresis Analysis**
  Partitioning and quantifying trace and major volatile organic components by electrical charge

• **Titrimetric Assay Analysis Procedures**
  - Acid-base, oxidation-reduction, etc.
  - Karl Fischer

• **Ultra-violet/Visible/Near IR (UV/Vis/NIR) Spectroscopic Testing**
  Concentration and/or purity measurements of major and/or minor organic components as well a film transmittance, and some component characterization (range from 190-1,000 nm)

• **Thermal Testing**
  - **Differential Scanning Calorimetry (DSC)**
    A thermal analysis technique that measures heat flow changes in a material as function of temperature and environment DSC applications include:
    - Thermal transitions (Tm, Tg, Tb)
    - % Crystallinity
    - Characterization of thermosets (percent cure, residual cure)
    - Reaction kinetics, oxidative stability
  - **Differential Scanning Calorimetry (DSC) - Modulated**
    A TA Instruments exclusive technique that applies sinusoidal heating rates to allow resolution of reversing and non-reversing transitions. Modulated DSC can also be used to determine thermal conductivity
  - **Differential Thermal Analysis (DTA)**
    Used for melting and transition data
o **Thermogravimetric Analysis (TGA)**
A thermal analysis technique that measures weight changes as a function of temperature and environment. TGA applications include:
- Thermal stability measurements
- Compositional analysis of co-polymers and filled polymers
- Volatile content of any material
- Decomposition kinetics and lifetime prediction

o **Thermogravimetric Analysis (TGA) - High-Resolution**
A technique that uses dynamic heating rates to enhance resolution of closely spaced and overlapping weight loss events.

o **Thermo-mechanical Analysis (TMA)**
For determining coefficient of thermal expansion (CTE/CLTE)

o **Dynamic Mechanical Analysis (DMA)**
A highly sophisticated and versatile thermo-mechanical technique that measures mechanical behavior of materials as a function of temperature, time (frequency), stress, and strain. The DMA can operate in oscillatory mode to measure dynamic properties such as $E'$, $E''$ and Tan-delta ($E''/E'$). The DMA can also operate in non-oscillatory mode to measure static mechanical properties such as creep and stress-relaxation. Applications for DMA are numerous and include:
- Stress/strain measurements
- Thermomechanical transitions
- Cure characterization of thermosetting pastes and pre-pregs
- Dynamic storage and loss moduli, compliance, Tan-delta
- Stress-relaxation

**Available test fixtures:**
- Single/Dual cantilever 10/20mm span
- Single/Dual cantilever 17.5/35mm span
- 20/50mm span 3-point bending
- Film/fiber clamp for testing thin films and fibers
- Compression clamps (also known as parallel plates)

o **Capillary Rheology**
A test technique that measures viscosity of polymer melts and most fluids as a function of shear rate and temperature. Capillary Rheology can be used to:
- Characterize molecular weight, thermal stability, and melt flow behavior
- Determine process ability of materials, e.g., shear-thinning behavior
- Perform quality assurance/control of resin lots
• **Physical Testing**

  o **Viscosity**
    - Intrinsic
    - Inherent
    - Shear
  o % **Volatile**s - (Gravimetric)
  o % **Solids** - (Gravimetric)
  o **Density** - Liquid or Solid
  o **Refractive Index**
  o **Scanning Electron Microscopy (SEM)**
  o **Melt Flow Index (MFI)**

Call or e-mail us for a quote or to discuss which tests will most effectively meet your requirements.

FBichard@hawkiplas.com or 860-450-1993