HAWK INTEGRATED PLASTICS

322 Main Street
Willimantic, CT, USA 06226
Phone: (860) 450-1993
Fax: (860) 450-1962

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

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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, $CHCl_3$, 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 $CHCl_3$)
  - **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

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- **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

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- **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

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

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

- **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)

- **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

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- **Physical Testing**
    - **Viscosity**
        - Intrinsic
        - Inherent
        - Shear
    - **% Volatiles** - (Gravimetric)
    - **% Solids** - (Gravimetric)
    - **Density** - Liquid or Solid
    - **Refractive Index**
    - **Scanning Electron Microscopy (SEM)**
    - **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