The Materials Characterization Laboratory is a staffed analytical research facility at the University of North Carolina at Charlotte that offers a range of thermal analysis and materials characterization instrumentation and services. The MCL serves as a research resource and shared instrument facility for research programs at UNC Charlotte and the surrounding region.

Located in Cameron Hall on the UNC Charlotte campus, the MCL accepts industry research projects provided there is equipment time available, there is not an equivalent research service offered by a for-profit company at a lower rate, and the industry users agree to, and sign a services agreement covering confidentiality and intellectual property.
ANALYTICAL SERVICES

THERMAL ANALYSIS
Thermal analysis is a branch of materials science where materials are characterized based on the changes in their properties as a response to temperature. The methods available are distinguished with respect to the property being measured. The MCL’s thermal analyses capabilities include:

• Dynamic Mechanical Analysis (DMA), a technique used to measure the mechanical stiffness and damping properties of a wide range of materials.
• Thermogravimetric Analysis (TGA), a technique used to measure the changes in weight of a sample during a controlled temperature program.
• Combined Thermogravimetric-Differential Scanning Calorimetry (TG-DSC), also known as Simultaneous Thermal Analysis (STA), is a technique used to simultaneously measure changes in mass (TGA) and changes in heat flow (DSC) on one and the same sample in a single instrument running a controlled temperature program.
• Thermal Conductivity (TCi), an analysis that provides a non-destructive method to measure both effusivity and thermal conductivity of fluids, pastes, solids and powders.

RHEOLOGY
Rheology is the study of the viscoelastic properties of liquids and soft solids that flow rather than deform elastically. MCL rheology equipment and services include a Rotational Rheometer used for determining the flow characteristics for fluids of any viscosity and polymer melts. Rheology is often used to establish the relationship between deformation (strain) and force (stress) imposed during the production of polymeric materials and other industrially important substances such as food and pharmaceuticals.

MICROCALORIMETRY
Calorimetric analyses accurately measure the rate of heat absorbed or evolved when a molecule of interest interacts with another molecule. Nano-Isothermal Titration Calorimetry (Nano-ITC) is used for binding and kinetic studies of either dilute aqueous or organic based solutions. Substrate kinetic and ligand binding studies further the understanding of the macromolecular interactions important in many solution based applications.

UNIVERSAL TESTING MACHINES (DUAL COLUMN)
These machines test a range of materials in tension, compression, flexure, shear and peel modes, and are used to predict how a material will perform under these types of forces. Textiles (fibers, yarns, fabrics), paper and other products can be run on the MCL’s 10 kN Universal Testing Machine. Applications include design testing in biomedical research, construction and consumer products.

CURRENT EQUIPMENT

• TA Instruments Q800 Dynamic Mechanical Analyzer
• TA Instruments AR2000ex Rotational Rheometer
• TA Instruments Low Volume Nano-Isothermal Titration Calorimeter
• TA Instruments Q500 Thermogravimetric Analyzer
• Setaram Instrumentation Sensys evo Calvet Thermogravimetric Analyzer/Differential Scanning Calorimeter
• TA Instruments Q600 SDT Differential Scanning Calorimeter/Thermogravimetric Analyzer
• C-Therm TCi Plane Surface Thermal Conductivity Analyzer
• Tinius Olsen H10KT Dual Column Load Testing Frame
• Evolved gas testing following TG-DSC analysis using FTIR or GC-MS is possible, but is not fully incorporated at this time.

OTHER FACILITIES
The MCL promotes interdisciplinary collaboration across departmental boundaries, and supports research strengths across the physical, biological and engineering sciences. Current researchers include architects, chemists, civil engineers, mechanical engineers and bioengineers. Access to instrumentation not included here can be arranged if availability permits. Please contact the MCL manager to learn more about additional testing options.

CONTACT
Internal student users should consult with their advisor prior to contacting the MCL for analytical needs. Your advisor should be aware of your interest in using the services provided in this lab.

External users from industry or other academic institutions are welcome to contact the MCL manager to inquire about arranging for testing services or setting up a project.

Dr. Katherine Weaver, Materials Characterization Laboratory Manager
704-687-0299 I http://eng-resources.uncc.edu/mcl/ or epic.uncc.edu