

MS 7001: Materials Laboratory Techniques (40 hours lab)

In this subject, students will be introduced to the principles and operation of selected materials characterization instruments. The emphasis is on thorough grounding of the principles of measurement and data interpretation. All of the instruments selected find extensive use in materials research. At the end of the course, the student is expected to be trained on the use of each instrument. No final exam will be given: testing is done in each laboratory.

Assessment: In the laboratories (100%)

1. Zeta potential/ Size Analyzer (Ceramics Lab, 8 hours)
Dispersion stability of tape casting suspensions; principles of suspension stability; principles of additives; particle size determination; zeta potential measurements; data analysis & interpretation of suspension behavior
2. Instron Mechanical Tester (Matls. Insp. Test. Lab, 8 hours)
Tensile and fracture toughness tests on polymer, ceramic and metallic samples; principles of crack behavior; data analysis and interpretation of load-displacement data and mechanical behavior in the presence of cracks; relationship to mechanical properties
3. Mechanical Spectrometer (Biomaterials Lab, 8 hours)
Time-dependent viscoelastic properties of semi-crystalline and amorphous polymers; viscoelastic solids and liquids; creep and recovery experiments; relationship to thermal transitions.
4. Differential Scanning Calorimetry (Polymer lab, 8 hours)
Preparation of polymer samples with different thermal histories (quenching and annealing); DSC measurements on the samples; interpretation of first heating, cooling and second heating curves; data analysis to obtain glass transition temperature, crystallization temperature, crystallization heat, melting temperature and heat of fusion; effect of thermal treatment on crystallization; effect of crystallinity on glass transition temperature
5. X-Ray Diffraction and Fluorescence (Advanced Characterization lab, 8 hours)
Principles of integrated crystallographic and chemical analysis; procedure for XRD collection and interpretation; chemical analysis using X-ray fluorescence spectrometry; backscattered electron imaging and processing; mass balance procedures; correlation of microstructure and processing XRD

Examination will be conducted at the end of each lab session. Examination will involve both theory and experiment.