THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Mechanical Behavior and Deformation Mechanisms of Noncrystalline Solids

MATSCEN 5762

Credit Hours:
3.00 - 3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate

Course Components:
Lecture

Course Description:
Physical mechanisms by which solids with noncrystalline phases deform and the corresponding mechanical behavior.

Prerequisites and Co-requisites:
Prereq: 3261.

Course Goals / Objectives:
- Develop an understanding of the deformation mechanisms in various noncrystalline materials and their relation to material structure
- Present experimental measurements of the mechanical response of noncrystalline materials
- Present theoretical models that relate deformation mechanisms in noncrystalline solids to mechanical response

Course Topics:

- A. Mechanics of deformation and stress: small and large strain measures of stress, strain, and rates thereof. Experimental measurement techniques to quantify rate and temperature effects.
- B. Glasses (oxide and metallic based): structure and defects in glasses; mechanisms of deformation as a function of temperature and strain rate; elastic and anelastic response; viscous and non-viscous flow; thermal and chemical stress and tempering.
- C. Polymers: structure/defects in polymers; deformation mechanisms; rubber-like elasticity; linear/non-linear visco-elasticity; observations as a function of temperature, frequency, and structure; anisotropy in sheets and fibers; yield criteria.
- D. Cellular materials: structure of foams and honeycombs; mechanisms of deformation; models and experimental measurements of elastic properties.
- E. Composite materials: polymer/glass reinforcements/matrices; models of stiffness/strength for particle- and fiber-reinforced matrices; long vs. short fibers and unidirectional vs. isotropic orientation; sandwich composite stiffness.
- F. Biological materials: composite structure of bone/soft tissue; mechanical response of elastin/collagen; uniaxial tensile/compressive response of bone; observations as a function of temperature and frequency; internal stress and remodeling.

Designation:

Elective