

Mechanical Behavior of Materials
Course Description
AAE 590: Spring 2013

This course serves as an overview for materials behavior for students without a materials background, including seniors and entry-level graduate students. Materials are at the foundation for all of engineering, as evident by the latest products that we design, to the airplanes that we fly, to the latest smart phones. In fact breakthroughs with material research are often accompanied by rapid advancements in technology. Thus it is paramount for all engineers to have an understanding of the structure and behavior of materials.

In this class, we focus on the structure of materials, the microstructure connection to mechanical properties, and ultimately failure mechanisms. Materials play an important role in both design and manufacturing, which will be addressed in the context of components and extreme environments. Of specific interest will be defects within materials, defect formation/evolution, and their role in strengthening mechanisms.

Material anisotropy, micromechanisms, and elasto-plastic properties at the atomic, single-crystal/constituent, and polycrystal/material levels and their use in explaining the deformation and failure characteristics in metals, polymers, and ceramics; failure mechanisms and toughening in composites; structure and behavior of metal-matrix composites, ceramic-matrix composites, and polymer composites. Particular topics will also include: elastic deformation, dislocation mechanics, plastic deformation and strengthening mechanisms, fracture mechanics, creep, and failure mechanisms; design criteria; special topics.