

MAE 21  
Aerospace Materials Science (4 units)

**Class/Laboratory Schedule:** Three hours lecture, One hour of lab (once every two weeks)

**Course Coordinator:** Shengqiang Cai

**Textbooks:**

1. Materials Science and Engineering: An Introduction, 10th Edition (Electronic version) or earlier version William D. Callister, Jr., David G. Rethwisch

**Catalog Description:** Atomic structure and physical properties of engineering materials including metals, ceramics, glasses, polymers, and composite materials. Defects and phase diagram of materials. Material testing and processing. Program or materials fees may apply.

**Prerequisites:** PHYS 2A or 4A, CHEM 6A or CHEM 6AH, and MATH 20B. Enrollment restricted to MC 25 and MC 35–37 majors only.

**Course Type:** Required

**Performance Criteria:**

Objective 1

Students can design mechanical testing methods to characterize mechanical properties of different materials.

Objective 2

Students can sketch atomic arrangements in BCC, HCP, FCC crystals; Students understand the definition of various defects in crystalline solids, including point defect, dislocations, grain boundary.

Objective 3

Students can successfully extract information from binary phase diagram of alloys

Objective 4

Students can explain the key differences of mechanical properties of metals, ceramics, polymer and composite.

Objective 5

Students can explain the mechanisms of strain hardening, solid solution strengthening, strengthening through the reduction of grain size.

Objective 6

Students can select the appropriate category of materials (polymer, ceramic, composite or metal) for different applications.

**Course Objective:**

1. To teach students the most basic knowledge of materials science.
2. To teach students how to conduct some fundamental materials characterization experiments.

**Course Topics:**

Macroscopic properties of materials

Crystalline structure

Diffusion in a solid

Dislocation and plastic deformation

Phase Diagram

Ceramics

Polymer

Composites

Last Updated: 13<sup>th</sup> May 2025