

**Department of Materials Science and Engineering
University of Maryland, College Park, Maryland**

ENMA 472: Technology and Design of Engineering Materials (Elective) – 3 credits

Class Schedule: Tuesday, Thursday 9:30-10:45 a.m.

Instructor: Dr. Isabel Lloyd

Textbook:

- R.A. Flinn and P.K. Trojan, Engineering Materials and Their Applications, 4th ed., John Wiley and Sons, 1995.
- Selected readings from the current literature will also be required.

Catalog/Course Description: Relationship between properties of solids and their engineering applications. Criteria for the choice of materials for electronic, mechanical and chemical properties. Particular emphasis on the relationships between the structure of solids and their potential engineering applications.

Pre-requisites: ENMA 300 or consent of instructor

Course Goals: The objective of this course is to explore the relationships between structure, properties and applications and how this can be used in materials and process selection and design. Students satisfactorily completing the class will:

1. Be able to make materials selection decisions based on material properties and process variables for metals, ceramics, polymers, semiconductors and composites.
2. Understand the relationship between property development and manufacturing processes and process variables.

Student Outcomes Covered by the Course:

ABET A: Ability to apply mathematics, science and engineering principles;

ABET C: Ability to design a system, component, or process to meet desired needs.

ABET G: Ability to communicate effectively;

ABET H: The broad education necessary to understand the impact of engineering solutions in a global and societal context;

ABET I: Recognition of the need for and an ability to engage in life-long learning;

Topics Covered:

- I. Introduction and Review: Bonding, crystal structures, planes and directions, non-crystalline and semi-crystalline materials, microstructure and its potential effects on properties, band model of solids, binary phase diagrams
- II. Properties of Materials and Their Relationship to Electronic Structure, Crystal Structure, Microstructure and Processing/Manufacturing:
Mechanical Properties

Optical Properties

Electrical Properties (conductors, superconductors, semiconductors and dielectrics)

Thermal Properties

Magnetic Properties

Environmental Stability

Composite Materials – what is a composite?, composites with “scalar” properties and composites with “new” properties

III. Case Studies- including student presentations