Syllabus

ENMA 470 - Materials Selection for Engineering Design

Instructor:  Tim Foecke
foecke@umd.edu
301-975-6592 (work at NIST)

Course Description: Increasing your knowledge about materials classes, properties, limitations and applications, and teaching you the methodology of materials selection in engineering design. "Making your stuff out of the right stuff".

1. Overview and scope of the course

2. Introduction to the CES materials selection software

3. Materials Intuition 101
   1. Materials-related design parameters: easy to hard
   2. The elements
   3. Metallic alloys: Fe, Al, Cu, Ni, Zn, Mg, Ti-based
   4. Polymers: polyolefins, polyesters, nylons, aramids, resins, elastomers
   5. Ceramics: cement, glass, nitrides, carbides, carbon-based
   6. Composites: GFRP, CFRP, cermets
   7. Natural materials: wood, rock, leather, bamboo, etc
   8. The weirdos: nanomaterials, active materials, amorphous metals, etc.

4. Processing Intuition 101
   1. Deformation processing: forming, forging, extrusion, moulding, casting
   2. Cutting: machining, blanking, hemming, etc
   3. Surface finish: painting, plating, nitriding, polishing,

   1. Review of important "material properties"

   2. The materials selection process

      1. Basic design cases: yield before break, leak before yield, buckling, etc

      2. Cost-based decisions

      3. Non-mechanical selection

      4. Multi-criteria

      5. Conflicting criteria

      6. Design for recycling / carbon footprint / energy cost / "green-ness"

   Case Studies All Along The Way

Grading: 25% homework, 25% group projects, 25% final, 25% class participation and quizzes

Office hours: in the classroom before and after as needed, special arrangements can be made also email questions any time