MSE 170B Fall 2008

http://courses.washington.edu/mse170/index.shtml

- Instructor: Prof. Miqin Zhang mzhang@u.washington.edu, (206) 616-9356, http://faculty.washington.edu/mzhang
- Lecture Section B: 12:30-1:20pm JHN075 MWF
- Office hour: Friday 1:30-2:30pm; Office: 302L Roberts
- TAs:

  Nik Hrabe (lead TA) nhrabe@u.washington.edu
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  Emmanuel Cua ecua@u.washington.edu
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- MS&E Engineering technicians

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  Kevin Soderlund (ME) kevins@u.washington.edu

MSE 170B Fall 2008

- Grading
  - Homework 10%
  - Midterm 15%
  - Final 30%
  - Labs 15%
  - Lab notebooks 5%
  - Project 25%

MSE 170: Introduction to Materials Science and Engineering

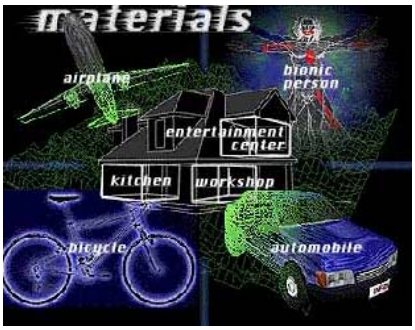
- Homework: due at 5PM every Friday; the Box in Mueller 168; No later homework; drop one lowest homework grade
- Labs: dropped from the class if you do not attend first week lab; team formation; print out lab manual from web; preread manual
- Lab notebooks: assigned by TA
- Group project: pick an application, find an appropriate material, test material, data analysis, final presentation in front of TAs and professor.
  - team formation (2nd wk)
  - project proposal (4th)
  - poster (10th)
  - project presentation (11th)

MSE 170B: Introduction to Materials Science and Engineering

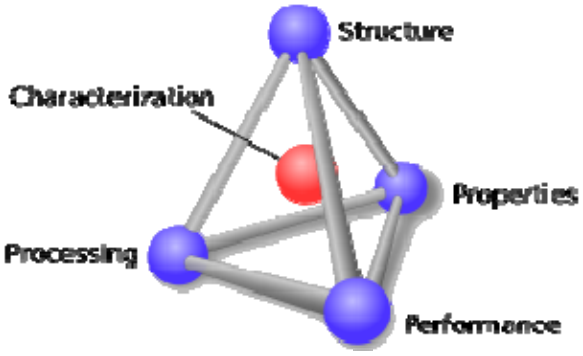
- Course objective
  - Introduce fundamental concepts in MSE
- You will learn about
  - Material structure
  - How structure dictates properties
  - How processing can change structure
- This course will help you:
  - Pick your next bicycle, pair of skis, or surfboard
  - Design an ACL artificial replacement
  - Start a company that makes a synthetic kidney and become rich and famous!

Why Materials Science & Engineering?

- Materials are everywhere!
- Almost every field has a bit materials!
- Materials are interesting!

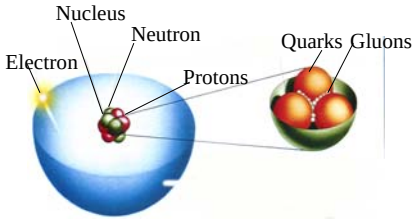


What is Materials Science?



Structure of Materials

- Atomic-scale structure
- Perfect crystal structure
- Imperfect crystal

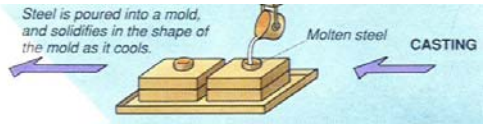


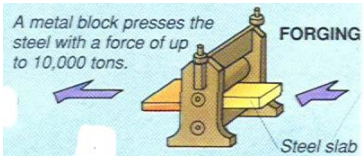
Properties of Materials

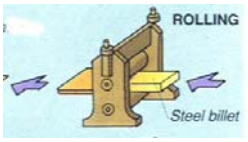
- Mechanical
- Electrical
- Magnetic
- Dielectric/optical
- Thermal
- Biocompatibility

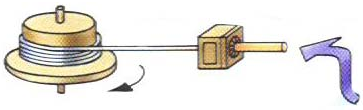
Materials Processing

- Casting
- Forming(forging, rolling, extrusion, and drawing)
- Powder processing
- Machining
- Joining









Drawing

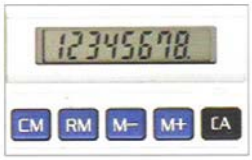
Class of Materials

- Metals
- Polymers/plastics
- Ceramics
- Semiconductors
- Composites
- Biomaterials
- Nanoengineered Materials

Class of Materials

- Metals
  - Iron and Steel
  - Alloys and Superalloys (e.g. aerospace applications)
  - Intermetallic Compounds (high-temperature structural materials)

- Polymers
  - Plastics & rubber
  - Liquid crystals
  - Adhesives



Class of Materials

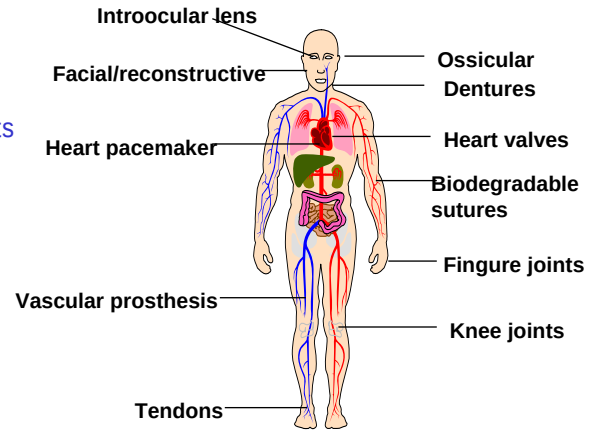
- Ceramics
  - Structural Ceramics (high-temperature load bearing)
  - Refractories (corrosion-resistant, insulating)
  - Whitewares (e.g. porcelains)
  - Glass
  - Electrical Ceramics (capacitors, insulators, transducers, etc.)
  - Chemically Bonded Ceramics (e.g. cement and concrete)

Class of Materials

- Composites
  - Particulate composites (small particles embedded in a different material)
  - Laminate composites (golf club shafts, tennis rackets
  - Fiber reinforced composites (e.g. fiberglass)

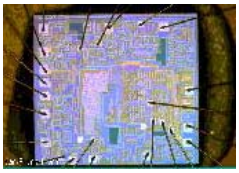
Class of Materials

- Biomaterials
  - Cardiovascular
  - Ophthalmological
  - Soft Tissue Implants
  - Dental
  - Orthopedic
  - Biotechnology



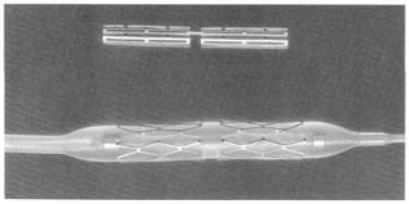
Class of Materials

- Semiconductor materials
  - Silicon and germanium
  - III-V compounds (e.g. GaAs)
  - Photonic Materials
  - Solid-state lasers
  - microelectromechanical systems (MEMS)



Advanced Materials

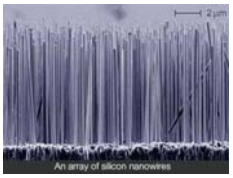
- Shape memory materials
  - made from metal alloys (Nitinol)
  - arterial shunts and repairs
- Metal superalloys
  - lightweight and strong
  - improvements in air and space travel

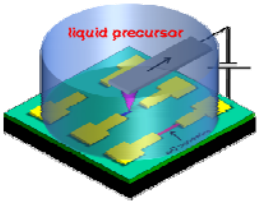


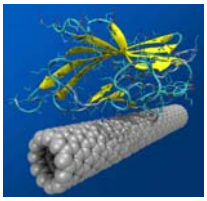
Balloon-expandable coronary artery stent

Advanced Materials

- Nano-engineered materials
  (nano= 10^{-9} ~ 10 000 smaller than diameter human hair)
- **Nanocrystals**
- **Nanotubes/nanowires**
- **Nanosensors**







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