MSE 170 Spring 2007

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

- Instructor: Prof. Miqin Zhang mzhang@u.washington.edu, (206) 616-9356, http://faculty.washington.edu/mzhang
- Lecture Section A: 8:30-9:20am Mueller 153 MWF
  Section B: 12:30-1:20pm Mueller 153 MWF
- Office hour: Wed 2:00-3:00pm; Office: 302L Roberts
- TAs:
  Sara Sepehri (lead TA) sepehri@u.washington.edu
  Ryan Buckmaster rbuckmas@u.washington.edu
  Fareid Asphahani, asphahan@u.washington.edu
  Matt Ferguson,mferg47@u.washington.edu.
- MSE Engineering technicians
  - Bob Smith, ras7@u.washington.edu
  - Tuesday Kuykendall, tuesday@u.washington.edu

MSE 170 Spring 2007

- Grading
  - **Homework 10%**
  - **Midterm 15%**
  - **Final 30%**
  - **Labs 15%**
  - **Lab notebooks 5%**
  - **Lab attendance 5%**
  - **Project 20%**

MSE 170: Introduction to Materials Science and Engineering

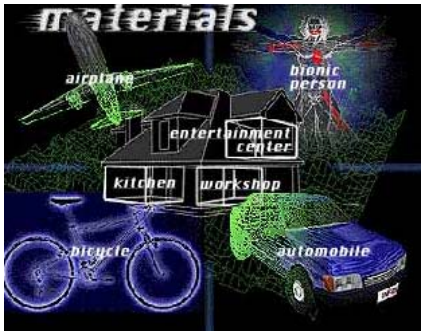
- **Homework: due at 5PM every Wed; the Box in Mueller 168; No later homework; drop one lowest homework grade**
- **Labs: dropped from the class if you do not attend first week lab; team formation; print out lab manual from web; preread manual**
- **Lab notebooks: assigned by TA**
- **Group project: team formation (1st wk); project proposal (3rd); poster and project presentation (10th)**
- **Book reading assignment**

MSE 170: Introduction to Materials Science and Engineering

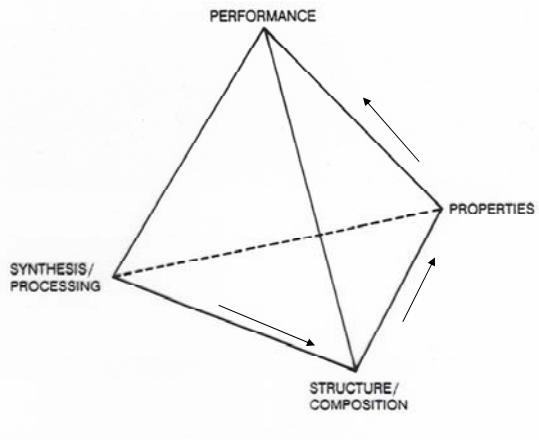
- Course objective
  - **Introduce fundamental concepts in MSE**
- You will learn about
  - **Material structure**
  - **How structure dictates properties**
  - **How processing can change structure**

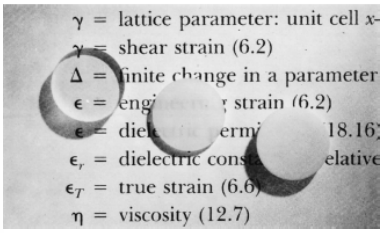
Why Materials Science & Engineering

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



Processing, Structure, Properties, Performance

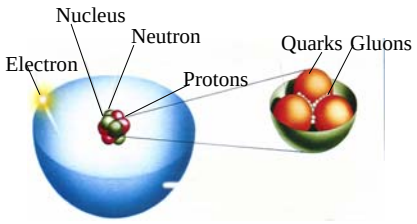




Left: single crystal
Middle: dense polycrystal
Right: porous polycrystal

Structure of Materials

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

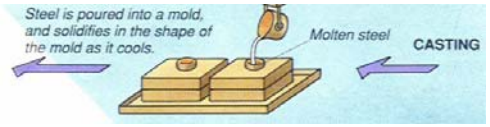


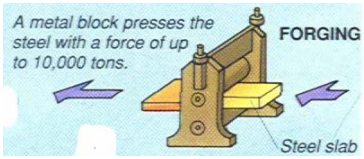
Properties of Materials

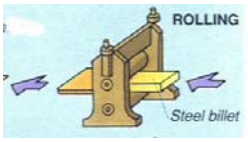
- Mechanical
- Electrical
- Magnetic
- Dielectric/optical
- Thermal
- Biocompatibility

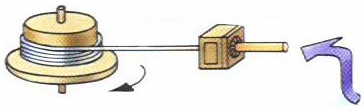
Materials Processing

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









Drawing

Class of Materials

- Metals
- Ceramics
- Polymers
- Semiconductors
- Composites
- Biomaterials

Class of Materials

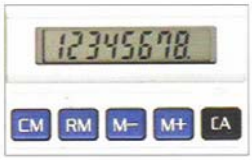
- Metals
  - **Iron and Steel**
  - **Alloys and Superalloys (e.g. aerospace applications)**
  - **Intermetallic Compounds (high-temperature structural materials)**
- Electronic materials
  - **Silicon and Germanium**
  - **III-V Compounds (e.g. GaAs)**
  - **Photonic materials (solid-state lasers, LEDs)**

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

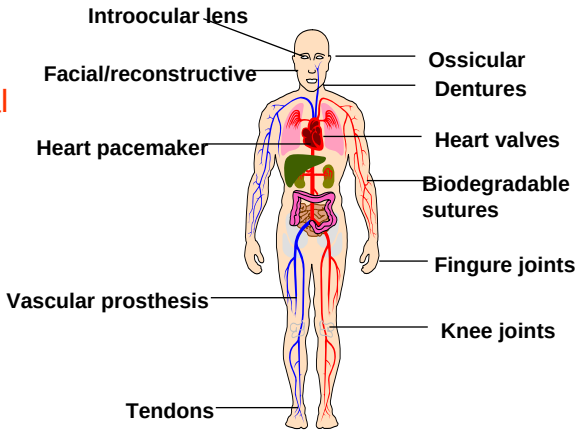
- **POLYMERS**
  - Plastics & rubber
  - Liquid crystals
  - Adhesives



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

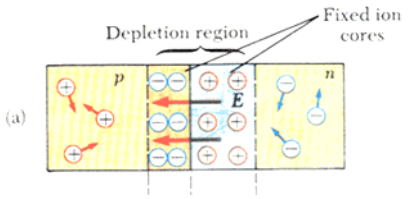
Class of Materials

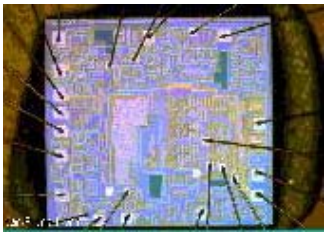
- Biomaterials
  - Cardiovascular
  - Ophthalmological
  - Soft Tissue Implants
  - Dental
  - Orthopedic
  - Biotechnology



Advanced Materials

- Semiconductor materials
  - faster signal processing
  - miniaturization
  - greater complexity and functionality
  - light emitting diodes (LED)
  - GaN (gallium nitride) blue light emitters
  - microelectromechanical systems (MEMS)



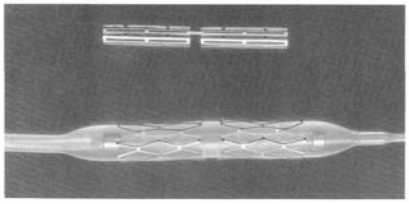


Advanced Materials

- Magnetic devices
  - development of fine particle magnetic materials
  - audio cassettes, video tapes, magnetic data storage in computer
- Optical fibers
  - faster, clearer data transmission
  - telephone, television, internet

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