COLORADO SCHOOL OF MINES
DEPT. OF METALLURGICAL & MATERIALS ENGINEERING

MTGN 584 NON-FUSION JOINING PROCESSES
Spring Semester 2008

Instructor: Dr. Stephen Liu (HH 254 / Ext. 3796 / sliu@mines.edu / www.mines.edu/~sliu)

Time: Mondays and Wednesdays, 3:45 - 5:00 P.M.

Room: HH211

Objectives: MTGN 584 is designed to provide an overall view of the joining processes in which the base materials are not melted. The three major areas to be addressed in detail in this course are: brazing, soldering and solid-state bonding. The theoretical aspects, as well as the processing aspects of these processes, will be discussed. Some insight into the joining of dissimilar materials systems will also be given.

Topical Outline:

1. Fundamental Concepts
   Wetting of Surfaces
      Concept of Surface Tension
      Degree of Wetting
      Phenomenon of Dewetting
      Contact Angle
   Filler Metal Flow
   Fluxes
      Flux Action in Oxide Removal
   Intermetallic Layers
   Joint Strength

2. Brazing
   Processes
Filler Metals
Fluxes and Atmospheres
    Chemical Nature
    Flux Development
Brazeability of Engineering Materials
Corrosion of Brazements

3. Soldering
    Processes
    Solder Alloys
      Solder Development
    Fluxes
      Chemical Nature
      Flux Development
    Solderability
    Corrosion of Soldered Joints

4. Transient Liquid Phase Bonding
    Process Mechanisms
    Process Modeling

5. Diffusion (Solid-State) Bonding
    Process Mechanism
      Temperature
      Time
      Surface Conditions
    Insert Materials
    Atmosphere
    Friction Welding
      Friction Stir/Stitch Welding

6. Explosive Bonding,
    Fundamentals of Explosive Bonding
    Process Variables
    Explosive Weldability
    Roll Bonding

7. Adhesive Bonding
    Adhesives
      Epoxy Type
      Polyester Type
      Heterocyclic Polymer Type
Anaerobic Type
Adhesion Theory
Materials Bonding
Aluminum Alloys
Ferrous Alloys

Course Grading:
3 Hourly Exams (15% each):
  02/06, 03/12, 04/23

2 Sixty-minutes Lecture Presentation (Dates TBA) plus Electronic
  Handout (distributed one week prior to lecture (15% each)

1 Journal-Quality Term Paper (different from the lecture
  presentation) or Critique of a Published Journal Paper (25%):
  Due 05/03

Total - 100%