FORM B

UNIVERSITY OF MASSACHUSETTS AMHERST
OFFICE OF THE SECRETARY
THE FACULTY SENATE

UNDERGRADUATE COURSE APPROVAL FORM
(Courses Numbered 001-599)

15 Copies Required for Courses Numbered 001-499
20 Copies Required for Courses Numbered 500-599

1. **DEPARTMENT, COURSE NUMBER AND TITLE:** ChE/MIE 572 Physical and Chemical Processing of Materials Lab

2. **SCHOOL OR COLLEGE:** College of Engineering

3. **Proposer's Name, Telephone and Email:** Prof. Dimitrios Maroudas, 5-3617, maroudas@ecs.umass.edu

4. **Proposed Instructors:** Dr. M. Rauf Gungor, Professor T. J. Mountziaris, and Professor Dimitrios Maroudas

5. **Course Credits:** 1

6. **Are there Prerequisites?** Yes **If yes, please specify** MIE 201

7. **What is the intended clientele?** Lower Division ____ Upper Division X

   Department majors only ____ Departmental/related majors X Non-Majors ____

   If course is intended for majors, what role will it play in the curriculum? Required ____ Elective X

8. **Complete Course Catalog Description (30 Words):** This is a one-credit laboratory course offered in conjunction with the 500-level course on Physical and Chemical Processing of Materials. It aims at enhancing the students' experience with and understanding of kinetic processes in materials.

9. **Please attach the following materials:**

   X Week-by-week outline of topics covered in course (or syllabus)
   X List of Required readings
   X Description of required assignments (papers, exams, projects, reports, presentations, etc.)
   X Summary of course grade criteria
   X Selected bibliography of works used by instructor in developing course, especially recent works (as appropriate)

10. **If course has been offered as an experimental or special topics course, please comment (on an attached page) on its evolution.**

Upon approval of the course by the department head, one copy of this form shall be sent from the departmental office to the Faculty Senate Office to allow for the course to be published on the University's Web Site for comment.

For courses numbered 500-599, the "Guidelines for Course Approval Form" from the Graduate Council must accompany the new course proposal.

DEPARTMENT OF CHEMICAL ENGINEERING
DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
University of Massachusetts, Amherst

ChE/MIE 572 **Spring 2010**

INFORMATION SHEET

Physical and Chemical Processing of Materials

Laboratory Requirement

Lab Hours:	1 Laboratory session every two weeks 120 minutes / laboratory session (Days and times to be announced)
Instructors:	Materials Engineering Certificate+ Program Team (Goldstein, Gungor, Hyers, Maroudas, Mountziaris)
Office hours:	Flexible or by appointment
Lab TAs:	To be announced
Room:	To be announced
Phone:	To be announced
E-mail:	To be announced
Office hours:	To be announced

Objective

This is a one-credit laboratory supplement to fulfill the requirements for the 500-level course on Physical and Chemical Processing of Materials. The laboratory goals and outcomes are consistent with those of the lectures.

Laboratory Experiments

- **Recrystallization**

Purpose: To demonstrate the recrystallization process as a function of temperature and time. To acquaint the students to characterization techniques, such as optical microscopy, SEM, and EBSD for crystallography.
Materials: Brass or work-hardened copper.
Lab activites: Work harden brass or copper by rolling, swaging, or a similar method that induces plastic deformation, followed by annealing at temperature levels for minimum recrystallization, maximum recrystallization, and grain growth. May use Amherst College EBSD unit to determine crystallography of work hardened and recrystallized grains. Effect of rolling – swaging direction can be observed. May plot start, 50%, and complete recrystallization at one temperature.

- **Age Hardening**

Purpose: To demonstrate precipitation behavior in strengthening an alloy. To observe the age hardening microstructure and relate to strengthening.
Materials: Al – Cu 4% alloy or equivalent.
Lab activites: Age harden specimens at various temperatures and for various times. Determine alloy strength by making microhardness measurements. Observe microstructure of alloy (particularly overaged alloys) with optical microscope. Observe microstructure of alloy at age hardening maximum using high resolution SEM. Vary temperature and time as related to mechanical properties.

- **Phase Diagram**

Purpose: To obtain 2-phase equilibrium boundaries in a specific alloy. To observe the microstructure directly as a function of time and temperature. To measure the equilibrium composition of each phase using electron microscopy.
Materials: Sn-Bi solder.
Lab activities: Melt and solidify several solder alloys. A thermocouple will be used to measure the liquidus and eutectic temperatures. In addition, alloys will be rapidly cooled to room temperature after solidification and a significant hold at a given temperature. The solidus and liquidus compositions will be determined using an electron probe microanalyzer on a flat polished sample of the alloy.

- **Phase Transformations**

Purpose: To observe phase transformations in steels, pearlite, spherodite, bainite, amd martensite using and optical and SEM techniques. Determine C curve behavior for a specific alloy.
Materials: 0.4 and/or 0.8 carbon steel.

Lab activities: Anneal alloys in all gamma region. Cool alloy at varying rates (cooling in air, water, oil, etc.) to obtain any one or several microstructures. Hold some specimens for a lengthy time to form spherodite. Observe microstructures by optical and SEM techniques and strength by microhardness measurements. Produce a set of photomicrographs showing various phase transformations for one composition of steel.

Note on Laboratory Infrastructure: Laboratory space, equipment (microscopes, thermocouples, and measuring/control devices), and materials are available from the instruction of MIE 302 and related courses.

Lab Outcome Measurement and Assessment

- Students will attend all of the laboratory sessions and prepare two reports for 2 of the 4 experiments.

Grading

Two lab reports – 50 % each.

Guidelines for Course Approval Forms (Forms B & C)
For Courses Numbered 500-999

The following is a detailed checklist of requirements that must be submitted in support of any course to be approved by the Graduate Council. This checklist is an addendum to Forms B (courses numbered 500-599) and C (courses numbered 600-999).

1. Is this course part of a program revision or a new program? If yes, please indicate how this course fits into this program, including whether it is a core or elective course.

   Yes. We have developed a 15-credit curriculum for a Materials Engineering Certificate. This certificate program involves specialized study in Materials Engineering with most of the requirements extending beyond the requirements of any individual major within COE and within the University in general. The Certificate students will acquire skills and knowledge specific to the discipline (or, as it is usually regarded, the interdisciplinary field) of Materials Science and Engineering.

2. Has this course been taught in another department before? If yes, please indicate the reasons why the course has been moved, including information on changes between this and the previous course. If the course is cross-listed, what is the department and course number?

   No. The courses will be cross-listed with the Mechanical and Industrial Engineering Department with the same course numbers as listed in the Chemical Engineering Department.

3. Is there a possibility that a course similar to this one is available and taught in another school/college/department or campus? If yes, please indicate the reasons why this new course is necessary. Also, include documentation of consultation with other schools/colleges/departments on this matter.

   No.

4. Would this course substitute for another course currently in the curriculum? If yes, please indicate whether the original course will be discontinued.

   No.

5. Would this course count for your own major? If no, please indicate its function such as service to a particular population, etc.

   Yes. It will provide a technical elective for students in the College of Engineering in addition to those who will be pursuing the Materials Engineering Certificate.

6. Is the proposed instructor a member of the graduate faculty? If no, please explain why non-graduate faculty would teach this course.

   All of the proposed instructors will be members of the graduate faculty.

7. <u>Within course submission, include the Syllabus, along with the following</u>:

   - New course number
   - Course description specific to the new course
   - Clearly specified course objectives
   - Week-by-week outline of topics covered in the course with a brief description of each of these topics & assignments for the week
   - Readings associated with each of the topics in the outline
   - Description of required assignments -- guidelines for papers or projects
   - Grading policy and specific grading criteria associated with each of the required assignments (with % or points converted to letter grades)
   - Anticipated enrollment
   - Selected bibliography of works used in developing the course
   - Accommodation policy (stated below)

- Academic honesty statement

If the course has been offered as an experimental (seminar) course, also include:

- Experimental (seminar) course syllabus
- Teaching evaluations (Note: Teaching evaluations are confidential and if included must be accompanied by a signed release from the instructor.)

Accommodation Policy Statement

Include this or a similar accommodation policy:

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), Learning Disabilities Support Services (LDSS), or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

Graduate School Interim Statement on Academic Honesty

It is expected that all graduate students will abide by the Graduate Student Honor Code and the Academic Honesty Policy (available at the Graduate Dean's Office, the Academic Honesty Office (Ombud's Office) or online at http://www.umass.edu/gradschool/handbook/univ_policies_regulations_a.htm). Sanctions for acts of dishonesty range from receiving a grade of F on the paper/exam/assignment or in the course, loss of funding, being placed on probation or suspension for a period of time, or being dismissed from the University. All students have the right of appeal through the Academic Honesty Board.