

MS 090

Materials Science Laboratory

Spring Quarter 2012

Catalog Data:

MS 90. Materials Science Laboratory. 9 units (1-6-2); third term. An introductory laboratory in relationships between the structure and properties of materials. Experiments involve materials processing and characterization by X-ray diffraction, scanning electron microscopy, optical microscopy and other techniques. Students will learn techniques for measuring mechanical and electrical properties of materials, as well as how to optimize these properties through microstructural and process control.

Textbook:

Laboratory Handouts, Various ASTM Standards

Prerequisites:

MS 115

Course Objectives:

The objective of this course is to familiarize students with a variety of materials characterization techniques commonly used in research and in industry. They will learn a number of laboratory techniques, simple data analysis, and standard reporting methods. Students will learn to apply theory to engineering problems, to perform experiments to obtain reliable data, to communicate the results of the engineering activities, and to develop a better understanding of the selection and use of materials

Lecture Topics:

1. Introduction - overview of characterization techniques - Bulk Measurements – Charpy (Izod), Bending, Tensile / Compression, hardness, creep.
2. Sample preparation, measurements and errors, (Lab 1 Overview).
3. Imaging Techniques - Light Microscopy, SEM (Lab 2 Overview).
4. Diffraction Techniques – XRD (Lab 3 Overview).
5. Electron Beam and Scattering - EDS, RBS (Lab 4 Overview).
6. Thermal Measurements – TMA, DSC, DMA, TGA, Laser Flash (Lab 5 Overview).
7. Physical and Electrical Measurements – AFM, BET, Profilometry (Lab 6 Overview)..
8. Mass Spec and SIMS
9. Electron Emission – XPS, Auger
10. Summary

Equipment, Location

- 3-point bending (Johnson)
- Hardness (Rockwell) (Johnson)
- Sample preparation (Johnson)
- Optical Microscope (Basement)
- Charpy (Johnson)

Subject to change at any time

- Instron (Johnson)
- SEM (Geology)

Laboratory

Lab #	Name	Equipment	Samples	Reference
1	3-Point bending Notch size Surface treatment	3- Point Bending set- up	90 quartz rods	ASTM D 790 Weibull
2	Partially work-hardened Brass "Jominy" sample Rockwell Hardness	Rockwell and Vickers Hardness Testers	12 Brass Ingots	ASTM E18-08b ASTM 384 ASTM 140 Hardness tester instructions
3	Sample preparation Optical Microscopy Grain size determination Grain Orientation	Metallurgical Microscope with image capture	Brass Ingots from Lab 1	Conner Pirtz et al, Berkeley Articles by Thompson and Mendleson
4	DBT and Charpy Testing	Charpy Tester	50 Charpy 1020 or 1018	ASTM E23
5	Tensile testing Stress-strain Engineering Strain	Instron Calipers	20 tensile samples	ASTM E8 Instron instructions
6	SEM - EDS	SEM/EDS		Goldstein, Newbury SEM Instructions

Course Schedule:

Lecture:

Time:

M 11:00-11:50

Room:

MRH 80

Instructor/TA

A.A.Shapiro/S. Roberts,

Laboratory

WF 9:00-12:00 TBD

Instructor: Andrew A. Shapiro, Lecturer in Materials Science and Applied Physics, Visiting Associate in Aerospace

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Tel: 818 393-7311
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TA Office Hours: TBD

Attendance Policy: Attendance is required for all laboratories

Grading Criteria: 6 completed laboratory reports are required to pass the course. Reports must be turned in at the lecture after completion of the laboratory work. Each lab must be completed during the assigned week. Late lab reports will automatically be downgraded one letter grade. There will be a quiz given at the lecture each week.

Laboratory Report = 90%

Quizzes = 10%

In this class, students must turn in individual laboratory reports for every laboratory although in some labs students may be required to work in small teams. Students may work together, although each student is required to independently write up their own laboratory report.