

## **APPENDIX M-1: MSE Lab Facilities**

### **Facilities**

The department occupies approximately 35,000 square feet of office and laboratory space on campus in Roberts, Mueller and Wilcox Halls, along with space in Wilson Lab and Wilson Annex. These spaces have been upgraded in recent years, with Mueller Hall being built in 1987 and Roberts Hall being fully remodeled in 1989. Full laboratory facilities are available for materials characterization and processing, computer analysis and structural examination. All facilities noted here are shared between the undergraduate and graduate programs.

#### **6.1 Classrooms**

Classroom space is available in Mueller Hall, with two 40-student classrooms and one 99-student auditorium (in addition to our 35,000 square feet of space). The department also utilizes seminar rooms in Roberts and Wilcox Halls, and classrooms in More and other nearby buildings, as needed. Classroom space is officially operated by a University pool, but the department has priority for scheduling classes in the Mueller classrooms. Mueller Hall also houses the bulk of our undergraduate laboratories, the undergraduate computing facility, lockers for students and a student society office and a student lounge.

#### **6.2 Laboratories and Computing Facilities**

Due to our shared belief that students learn best by doing, there is a heavy emphasis on laboratory component in the curriculum. In order to support this component of our program, we maintain a number of laboratories primarily for undergraduate student use. In addition to undergraduate laboratories, students have access to needed research laboratories maintained by the department. Finally during the Senior project, the students use a variety of laboratories both within and outside the department. The labs maintained by the department include facilities for materials processing, polishing and sample prep, optical and electron microscopy, mechanical properties, electrical properties, X-ray diffraction, and thermal analysis.

The students use computers extensively in our program. The department maintains state of the art computing facilities. In addition to the department's computing facilities, students can utilize any of the university computing rooms, which are well equipped with personal computers. All university students pay a technology fee of \$40 per quarter to pay for upgraded computing facilities. Portions of the resultant funds are allocated by a university committee to support departmental and to university-wide computing needs.

The laboratories in the Department of Materials Science and Engineering need continual upgrades in equipment and facilities to provide for a first class education for both our undergraduate and graduate students. These laboratories have been upgraded since 1989 as a result of private contributions of \$1.5M and funding from the state and federal governments. Expenditures for equipment used exclusively for teaching totaled over \$850,000 over the past 10 years. These funds have allowed upgrades in the areas of materials processing, computer analysis and control, sample preparation, spectroscopy and analysis, and x-ray diffraction.

However, the task of equipment replacement and upgrading is never complete due to the explosive growth of analytical capabilities in the materials analysis area. With the advent of computer-controlled analysis and measurement systems, another challenging area is the need to upgrade computing systems and software. Overall, it is estimated that over \$150,000 annually will be required over the next decade to ensure that the Department has fully updated laboratories in the year 2010. Funding for these laboratory facilities upgrades will come from a combination of private donations, state appropriations and grants from the federal agencies. These activities are ongoing, with different emphases depending on the availability of funds and the likelihood of success. Funding sources include private donations, state appropriations and federal grants. Upgrade and maintenance of equipment is a high priority in our development campaign for private donations.

### **6.3 Equipment Needs of the Department**

- A. Oct 8, 2003, memo from Bob Smith, Scientific Instructional Technician, to Raj Bordia, Chair:

To: Raj Bordia, Chair  
From: Bob Smith, Scientific Instructional Technician  
Date: Oct 8, 2003  
RE: Lab Equipment

Hi Raj,

I have been assessing the equipment situation in our Undergraduate labs and wanted to share my findings. I have gone through all the departmental labs to determine exactly where we stand on equipment and resources. I have also incorporated input from the TA's, all Faculty, and the Graduate students. Using all of this information, I have compiled some lists, with the goal of upgrading the departmental labs for teaching purposes and general usage by all Undergraduate and Graduate students. However, since the labs are most importantly used by the Undergraduates for teaching labs and their senior projects (MSE499), that is where my main emphasis will be.

Attached to this memo are four lists. These lists contain the following pieces of information;

1. List of equipment available to students presently. This list was generated last fall (Autumn 2002), however all pieces are still present and accounted for, less equipment purchased in the past year.
2. List of equipment acquired during the past one year (2002-03). Equipment on this list has not been added to List #1.
3. List of equipment that will be purchased during this school year (2003-04)
4. List of equipment that is planned for future upgrades (some items are currently seeking funding)

If you have any questions or comments on this list, please feel free to contact me to discuss. Thanks,

## B. Equipment lists:

### 1. List of equipment available to students presently.

<b>Mechanical Testing Room</b> Instron 4505, full size unit Instron 1122, table top unit Assorted Instron fixtures Hand rolling mill 4 salt pots Bottom Loading furnace (melts) Grind-O-Sonic modulus tester	<b>Processing Lab (165)</b> Drying oven 2 Carver hydraulic presses Loomis hydraulic press, large 2 heating plates for presses Pyrometric cones Cold isostatic press Large diamond saw Small ball mill Small attrition mill Jominy end quencher Tetrahedron hot platen press Large attrition mill 4 assorted hotplates	<b>Machine Shop</b> Tablesaw 2 drill presses Metal lathe Precision grinder/slicer Horizontal bandsaw Vertical bandsaw 2 bench grinders (lg and sm) Bridgeport milling machine Bench shear Foot shear MIG welder Oxy/acet welder Arc welder Sandblaster Solvent tank
<b>Polishing Lab</b> 2 Rockwell hardness tester 1 Rockwell superficial hardness tester 2 sample mounting presses 3 belt sanders Buehler abrasive sample saw 6 polishing wheels Auto-polisher w/ moulder Ultrasonic bath Stereoscope (small for sample etching) Isomet slow speed saw	<b>XRD Room</b> Philips 1820 X-ray diffractometer Philips open beam diffractometer Jade analyzation software Shimadzu microhardness tester	<b>Processing Lab (167)</b> Thompson lab mill (macerator) Toledo large scale Sonic dismembrator Diamond tile saw 2 mineral crushers Brookfield viscometer Micromeretics sedigraph Porosimeter 2 precision balances Magne stir 3 level ball mill vacuum pumps
<b>Furnaces in both process labs</b> 5 to 1100°C temp 1 to 1200°C temp 2 to 1700°C temp 1 large upright to 1000°C	<b>Microscopy Center (supervised)</b> Joel 5200 SEM Philips EM400 TEM Philips EM420 TEM Katan ion mill 2 dimplers SBT slurry cutter 2 SBT disk grinders SBT tripod polisher SPI sputter coater Full darkrooms for processing	<b>Undergraduate Microscope Lab</b> 10 assorted microscopes (one w/ camera, monitor) 2 stereo microscopes
<b>Electrical Properties Lab</b> 2 LCR meters 2 oscilloscopes 3 1100°C furnaces 2 frequency generators LabView data acquisition	<b>Graduate Microscope Lab</b> 1 microscope with Nikon Coolpix 990 digital camera, computer, scanner 1 stereoscope	<b>Assorted Areas</b> DTA FTIR MTS dynamic tester Izod impact tester Charpy impact tester

## 2. List of equipment acquired during the 2002-03 year.

New Philips XRD controller software, computer, printer	Polarization kits
New Jade XRD analyzation software, computer, printer, desk	Polarization sheets
New Instron controller software, computer, printer, desk	Demo pieces (for open houses, school demos, etc);
New NDT tools; Magnaflux tester and accessories	Piezo flash rocks
Zygo-style crack detection kit	Potato clock
Black light crack detection kit	Superconductor & magnet kits
New Haas CNC milling machine (presently on order)	Assorted magnets
Acoustic Emission Analysis system	Solar cells
2 new power supplies	5 Door mag card readers to allow more student access
2 digital pH meters	3 Fluke dual input thermocouple readers
	6 Rockwell B, N, and C indenters
	Small stereoscope
	Slide micrometer

We have just gotten approval for a \$75,000 upgrade of one of our labs, to be utilized as a new furnace and prep lab. This will include new work stations, tables, ventilation, and other amenities to help students.

## 3. List of equipment to be purchased during 03-04 school year.

Processing Lab	Polishing Lab
• Ball Mill Media	• Special fabrics and abrasives for polishing wheels
• Glassware	• Isomet
• Locking Cabinets	• More pH Meters
• More pH Meters	• Glassware w/ locking cabinet
• More Thermocouple Readers	
Microscopy Lab	XRD Lab
• New Lenses	• Small holding fixtures
• Mag Card Lock	

#### 4. List of equipment planned for future upgrades.

##### Processing Lab

- Tape Caster
- Picnometer
- More Balances
- More Viscometers
- Particle Size Analyzer (--funding presently applied for--).
- BET
- Acid saw
- Furnaces (some environment-adaptable)
- Thermal Analysis Teaching Equipment
- Autoclave (--funding presently applied for--)

##### Polishing Lab

- Microhardness Indentor
- Rockwell Hardness Indentor
- Stereomicroscope
- New Abrasive Saw
- More hot mounting presses

##### Microscopy Lab

- Stereomicroscopes
- Scopes Locked in Cabinet
- Quantimet (quantitative phase microscope)

##### Teaching Supplies

- New Projectors for Powerpoint presentations in class

##### Instron Room

- New controller for current frame to allow strain gage inputs and loading/unloading advance test methods (--funding presently applied for--).
- Non Contact extensometer for Instron (either video or laser)
- Temperature/environmental chamber for Instron
- Wire drawing dies and fixtures
- Soft material grips
- Hydraulic or pneumatic grips for instron
- 3 Tabletop Instrons
- Fatigue Machines

##### XRD Lab

- New XRD
- Searching Software upgrade (--funding presently applied for--)
- Residual Stress measurement fixture (--funding presently applied for--)
- Better movable shielding
- Automatic pole-figure plotter (or some device for texture determination)

##### Electrical Properties Lab

- Software Update
- New LCR Meter/Impedence Spectrometer (--funding presently applied for--)
- Oscilloscopes
- Thermocouple Readers
- Voltmeters
- Computer Updates
- Piezometer (--funding presently applied for--)