

**MEEN 335**  
**Materials Processing Laboratory**  
**EXPERIMENT # 1-Metallography**

**OBJECTIVE:** To learn specimen preparation techniques in metallography and study the microstructures of typical engineering alloy(s).

**EQUIPMENT USED:** Buehler Metallurgical Cutting Apparatus, Simplimet mounting press, Handimet Grinders, polishing wheels, drying fans, and metallurgical microscopes.



**SUPPLIES:** Etching solutions and consumable supplies as needed and given engineering alloy specimens.

**REFERENCE MATERIAL:** Operating instruction of the equipment to be used.

**METALLOGRAPHIC STUDY:** Using a steel and/or brass (60% Cu; 40% Zn) specimen, and the metallurgical microscope, analyze the microstructure of your given engineering alloys.

Identify the phase or phases present and the grain size of the material from your metallographic examination. Study the microstructures using the metallurgical microscope and appropriate phase diagrams. Provide interpretation of your microstructures and prepare a laboratory report of your experiment.

**PROCEDURE:** See attached experimental procedure.

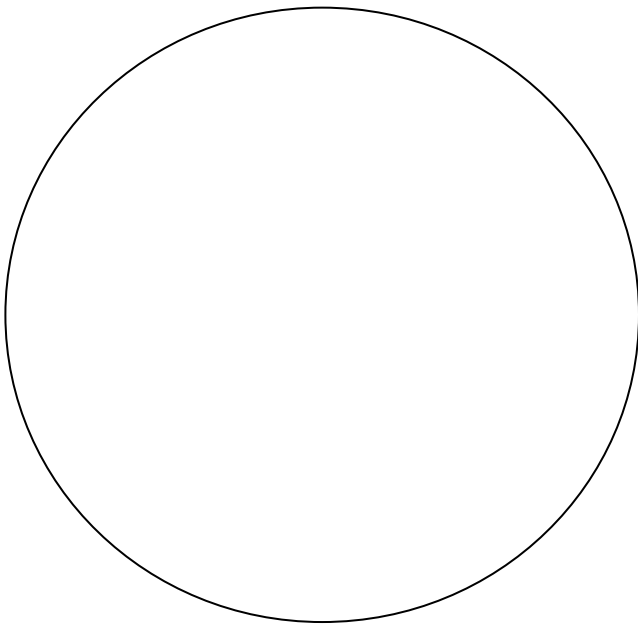
**ASSIGNMENT:** Each student is to prepare metallographic specimens as provided in the laboratory, and to sketch and show typical, representative microstructure of these specimens.

Draw the microstructure you observe in your specimens. Comment on the phases, composition of the phase(s), amounts of phase(s), and estimate the ASTM grain size of the microstructures.

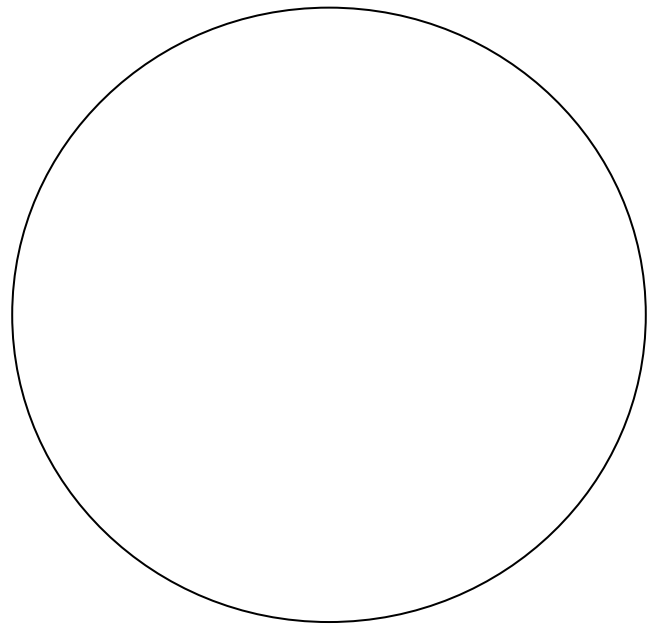
1. Using phase diagram information, identify in your results the phases, amounts of phases and types of microstructures that you observe in your metallographic analysis.
2. From your understanding of grain size, calculate or give an estimate if the material is coarse grained or fine grained, with its approximate ASTM grain size number.
3. Comment on type of deformation or heat treatment the specimen might have undergone.

**Metallography Observation Record**

Grind, polish, and etch the two specimens given to you. Draw the microstructures you observe in your specimens.



Magnification:  
Specimen:  
Etchant:  
Observation:

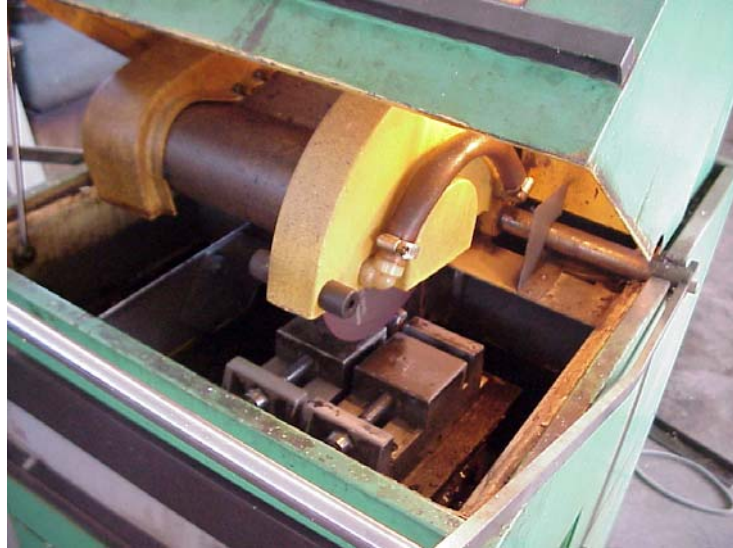


Magnification:  
Specimen:  
Etchant:  
Observation:

**MEEN 335**  
**Experimental Procedures**  
**Experiment #1**

**I- Specimen Preparation**

*Buehler Metallurgical Cutting Apparatus Operating Instructions*



The Buehler Metallurgical Cutter uses an 8-inch circular cutting disk. The cutter also has a built in coolant system that uses water as its coolant.

**Procedure:**

- (1) Place metal in the vise
- (2) Close cover
- (3) Press the coolant button to the "On" position.
- (4) Open water line located behind the metallurgical cutter.
- (5) Turn the "On - Off" switch to "on" position.
- (6) Slowly lower the vise arm until cutting is complete. (Release arm)
- (7) Turn off coolant switch.
- (8) Turn the "On - Off" switch to "Off" position.
- (9) Open cover.
- (10) Unscrew vise and remove specimen.

**CAUTION:**

Do NOT place metal in vise or remove metal from vise while machine is in "on" position.

## II. MAKING SPECIMEN MOUNTS:

### A- Thermosetting Bakelite Premold Material Using Simplimet Press



Close the release valve hand wheel and pump mold base midway up the cylinder. Lock mold ram and mold closure assembly into place. Place automatic heater over cylinder. Allow system to preheat for at least 25 minutes.

Remove mold ram and closure assembly. Pump mold base up all the way. Position specimen, flat surface down, on mold base. Open release valve hand wheel to lower mold base, and insert a heated premold into cavity of mold cylinder. Replace mold ram and closure assembly and lock into place.

### B. Thermosetting Bakelite Powders:

Follow previous instructions with the exceptions:

Rapidly load and apply pressure where powder is used with hot mold. If this is not possible, the operation must be initiated with mold assembly no warmer than 160 degrees F (71 degrees C). To prevent "Circumferential Splits", powder should be preheated to 185 degrees F (85 degrees C) prior to loading.

In, all cases, where the operation is initiated with a preheated mold assembly, a degassing cycle is required in which full 4200 PSI pressure is applied immediately after loading, immediately release, reapplied, released again, and finally reapplied and maintained for duration of melting and curing cycle.

Or, if desired, mold assembly may be allowed to cool to 160 degrees F (71 degrees C) prior to loading, and then heated to full temperature with no degassing cycle.

### C. EJECTING THE FINISHED MOUNTS:

**\*\*USE GLOVES THROUGHOUT THIS OPERATION\*\***

Release pressure. Carefully remove mold ram and mold closure assembly. Close release valve hand wheel and pump operating lever until mount is accessible. Remove mount and allow to cool normally to room temperature.

Remove flash and adherent cured molding material from mold base, and around mouth of mold cylinder. Recoat parts with No. 20 -3046 AB Silicon Mold Release Fluid if furnished mounts tend to adhere to molding surface.

**III-Buehler Handimet Grinders**



The Buehler Handimet Grinder is used to buff metal surfaces. The Handimet Grinder uses either I roll abrasive, or abrasive adhesive paper. The Grinder has four flat grinding surfaces. Each surface has a different grit abrasive. The grits are 240, 320, 400, and 600. The grinder also has a built-in coolant system, which uses water as its coolant.

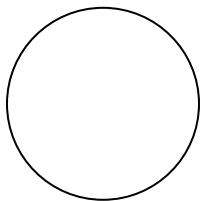
**Procedure:**

- (1) Open water line located behind grinder.
- (2) Turn coolant on by turning coolant knob slightly counterclockwise.
- (3) Starting on the 240 Grit surface, place prepared specimen, or metal face down of abrasive surface, and being sliding specimen against abrasive in a forward and backward motion. Continue this process until specimen's surface looks like that in Figure 1a.
- (4) Next, turn specimen 90 degrees and repeat above procedure on the 320 Grit surface until the specimen reveals a surface like that in Figure 1b.

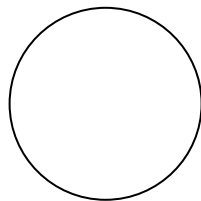
### III-Polishing Wheels



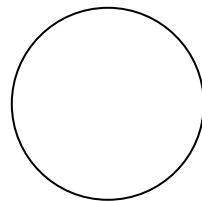
- (5) Again turn specimen 90 degrees and repeat procedure (3) now on the 400 Grit surface until the specimen's surface look like that in Figure 1c.
- (6) Finally, turning specimen 90 degrees and repeat procedure (3) now on the 600 Grit surface until the specimen reveals a surface like that in Figure 1d.
- (7) Turn coolant off. Close water line.



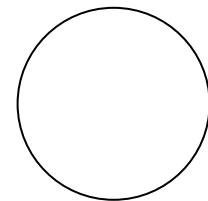
**Figure 1a**



**Figure 1b**



**Figure 1c**



**Figure 1d**