

Microstructure Analysis

Procedure and Materials required

Specimen Preparation

- Cutting to appropriate size (1 inch X 1 inch – ASTM E3)
 - Can be done using the band saw
- Mounting the specimen in resin
- Grinding the specimen
- Polishing the specimen
- Etching the specimen
- Looking under the microscope

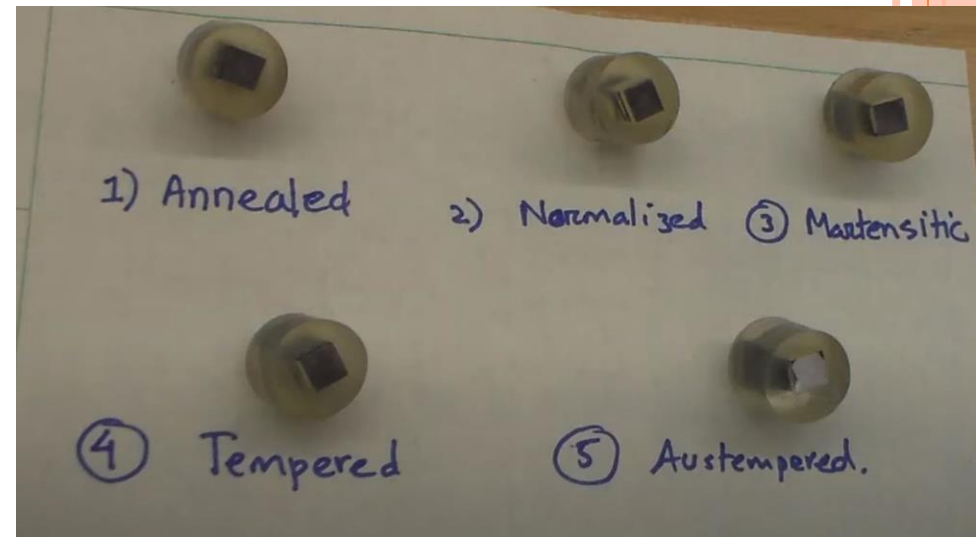


1. Mounting the specimen



Involves mixing 3 parts acrylic resin powder with two parts hardener liquid and pouring the mixture in a plastic mounting ring

Let the specimen sit for an hour before grinding



2. Grinding/Polishing the specimen



Silicone Carbide Grits

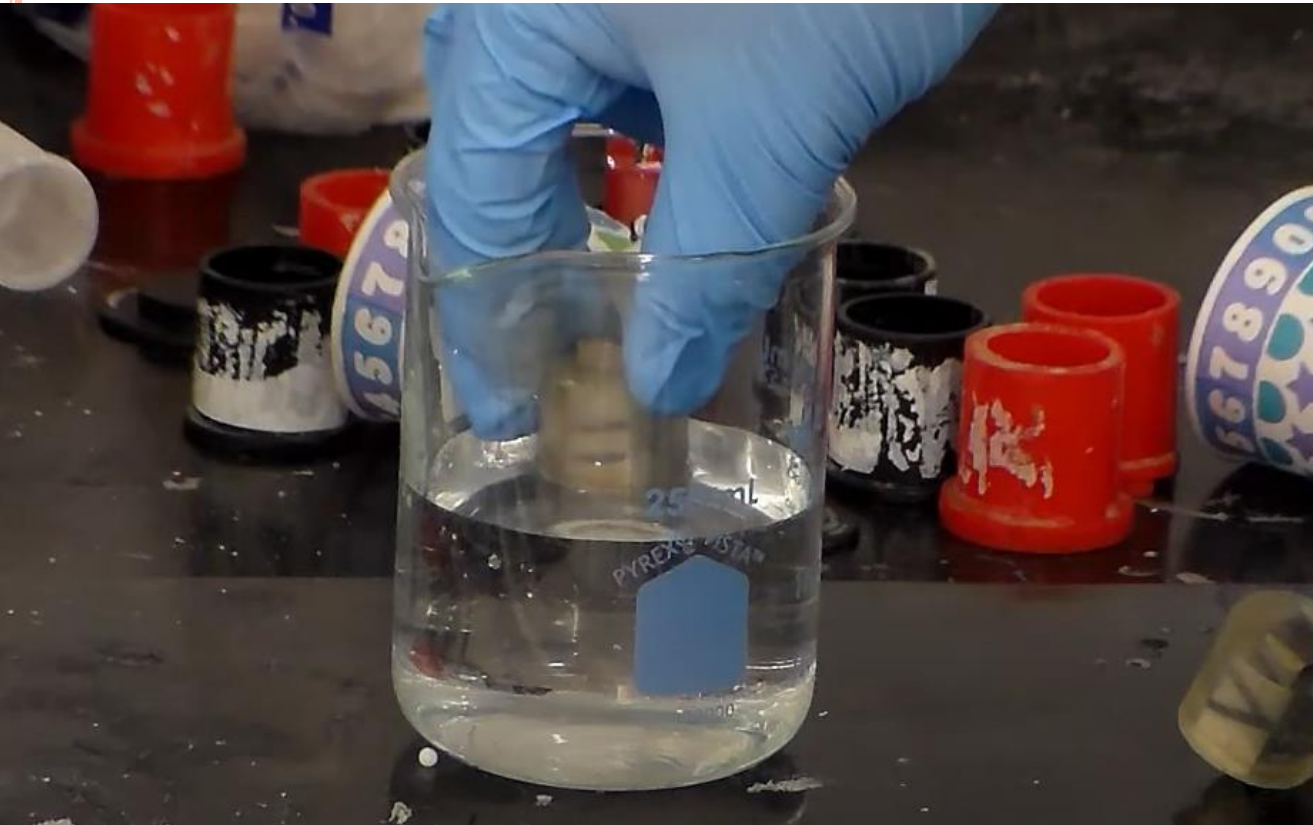
Coarse Grinding – 120-180 grits

Fine Grinding – 240, 320, 400, 600 grits

Mechanical Polishing - Aqueous suspensions of 600-grit, 5.0- μm , 0.3- μm , and 0.05- μm aluminum oxide or alumina powder



3. Etching the specimen



Etching by immersion
for a designated time

2-2.5 mL HNO_3

100 mL ethanol solution

Mixing the two liquids and etching



4. *Microscopic analysis*



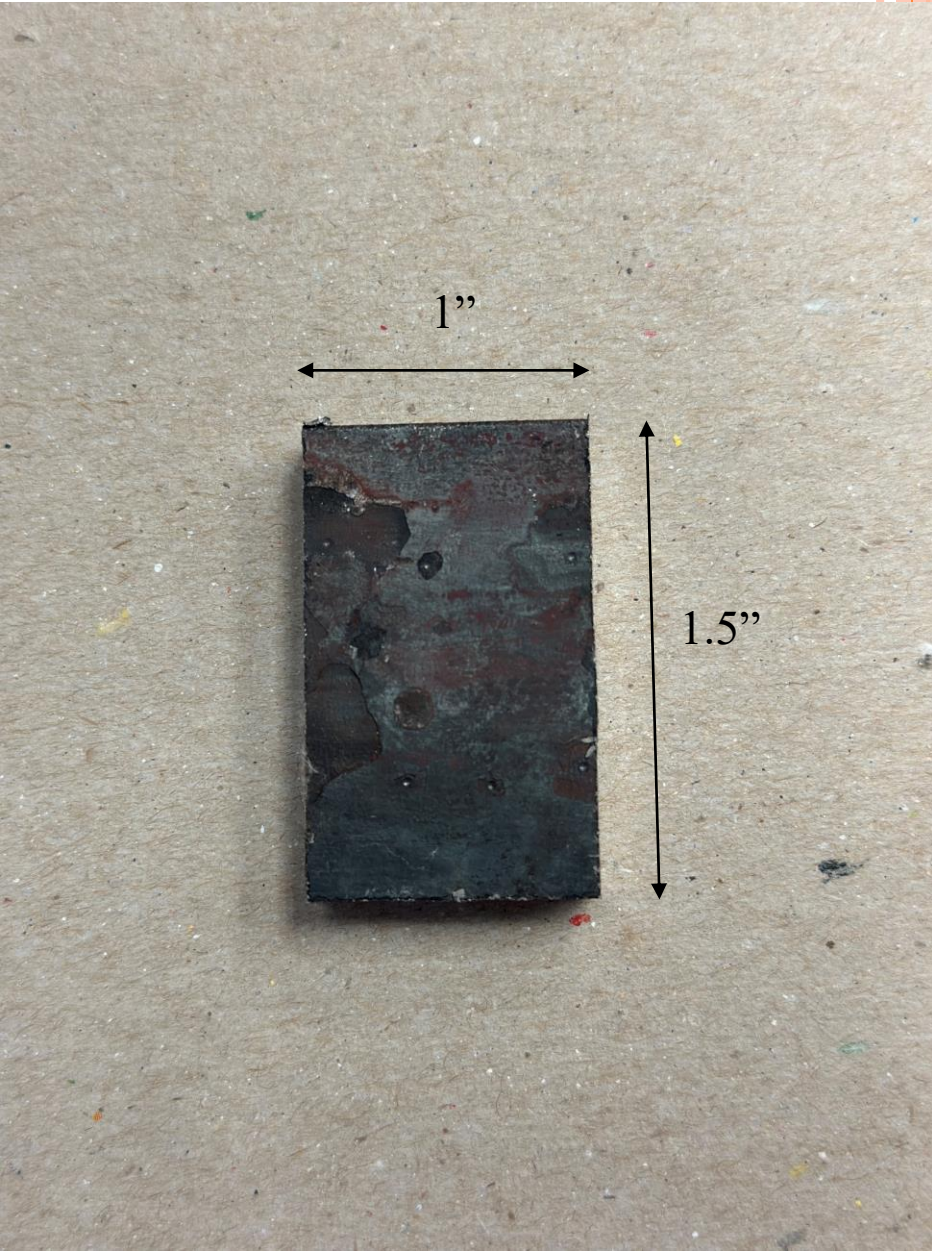
Magnification required up to 1200X

Material Required

- Mounting – Plastic Mounting cups, Acrylic resin powder, Hardener liquid, Beaker
- Polishing and Grinding – Grinding and polishing machine, 120 to 600 size grits, Micro cloth/nylon cloth with 5-micron, 0.3-micron and .05-micron aluminum oxide/alumina powder
- Etching - 2-2.5 mL HNO_3 , 100 mL ethanol solution, Beaker to mix



Microstructure analysis: Cutting



Microstructure analysis: Polishing and Grinding



- Using the polishing and grinding machine
- SiC Grit discs are attached to the metal disks which rotate at required RPM



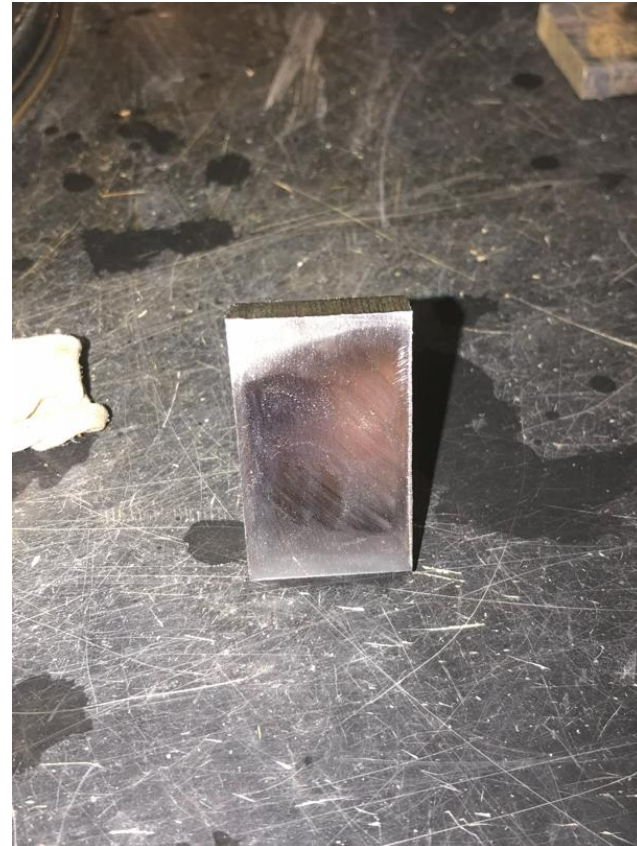
Microstructure analysis: Polishing and Grinding



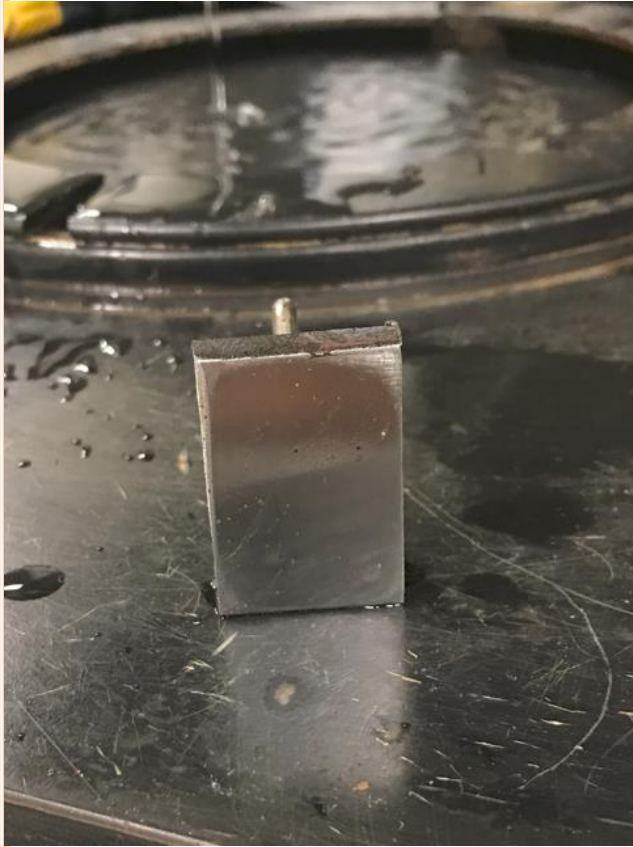
- Magnet connected to the steel piece and the piece is pushed against the rotating disc
- Supply of water provided during the grinding and polishing operation



Grit 80



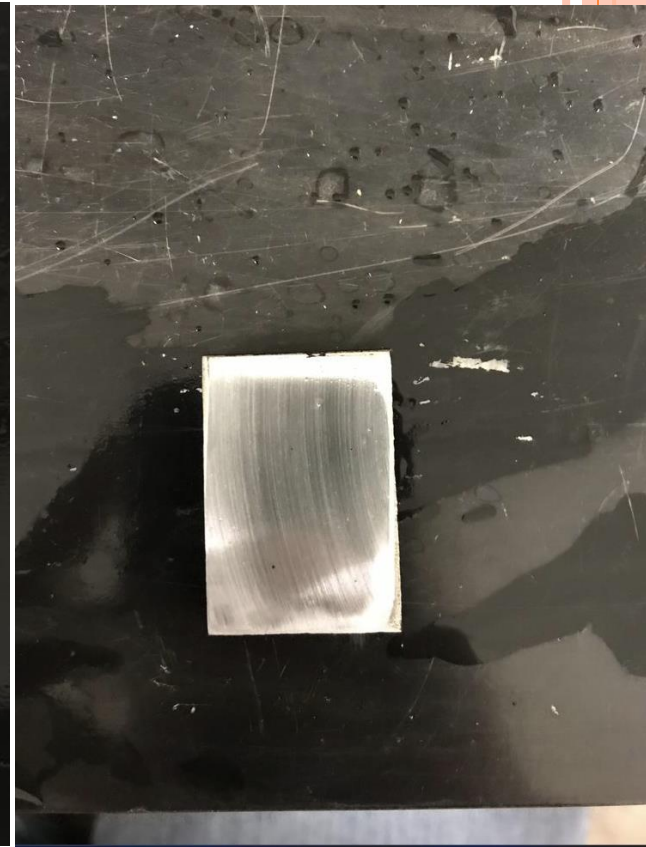
Grit 120 & 180



Grit 240



Grit 320



Grit 400

Microstructure analysis: Polishing and Grinding



Grit 600

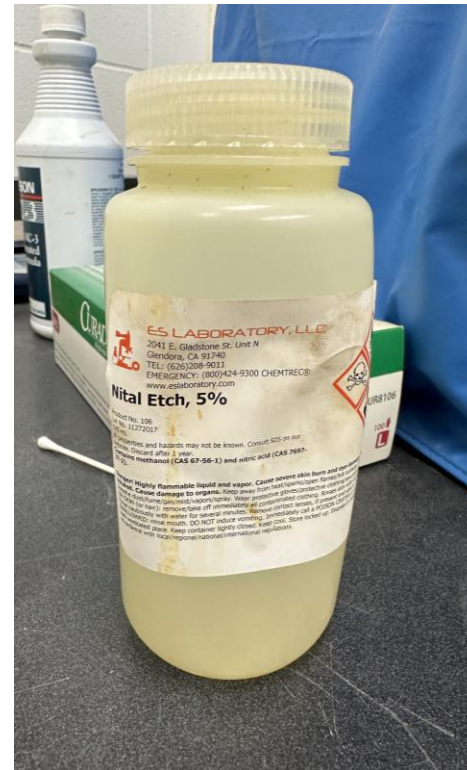


Grit 1200 – P 2500



Grit P 4000 – 5 μm

Microstructure analysis: Etching



Nital Etch



**Acid
Neutralizer**

- Etching by swabbing
- Using Nital etch and rubbing the swab against the steel surface for 30-45 seconds
- Application of acid neutralizer and rinsing with water



Microstructure analysis: ASTM E3

TABLE 5 Preparation Method 1 (General Use)

Surface	Lubricant	Abrasive Type/Size ANSI (FEPA)	Time sec.	Force ^A N(lbf)	Platen RPM ^B	Rotation
Planar Grinding paper/stone	water	120–320 (P120–400) grit SiC/Al ₂ O ₃	15–45	20–30 (5–8)	200–300 ^C	CO ^D
Fine Grinding paper	water	240 (P220) grit SiC	15–45	20–30 (5–8)	200–300	CO
paper	water	320 (P500) grit SiC	15–45	20–30 (5–8)	200–300	CO
paper	water	600 (P1200) grit SiC	15–45	20–30 (5–8)	200–300	CO
Rough Polishing low/no nap cloth	compatible lubricant	6µm diamond	120–300	20–30 (5–8)	100–150	CO
Final Polishing med./high nap cloth	compatible lubricant	1µm diamond	60–120	10–20 (3–5)	100–150	CO
synthetic suede ^E	water	0.04µm colloidal silica or 0.05µm alumina	30–60	10–20 (3–5)	100–150	CONTRA ^F

^A Force per 30 mm (1¼ in.) diameter mount.

^B Power heads generally rotate between 25 and 150 rpm.

^C High-speed stone grinders generally rotate at greater than 1000 rpm.

^D Complimentary rotation, surface and specimen rotate in same direction.

^E Optional step.

^F Contra rotation, surface and specimen rotate in opposite directions.

- P 4000 grit – 5 µm



Microstructure analysis



Magnification required up to 1200X