



BUEHLER

Quality At Work - Geological & Mineralogy Guide

Sample Preparation

Mounting Consumables

Encapsulation & Impregnation

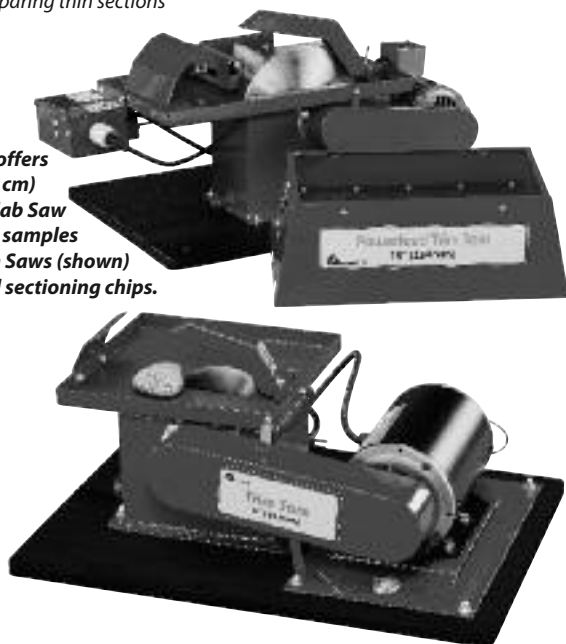
Grinding & Polishing

Petrographic Microscopy has played an essential role in geological and mineralogical research ever since the invention of the optical microscope. Since its invention, SEM, EDS, microprobe and x-ray diffraction microanalysis investigations have quickly flourished and are being used to identify minerals and quantify a wide variety of their characteristics. These instruments, now routinely used on minerals, clinkers, and refractory brick, require high quality polished specimens.

Today's automated mineralogy systems offer the geologist, metallurgist and mineralogist new tools for interpretation of rock texture and rapid identification of minerals. These automated systems identify minerals from polished sections obtained from particulate, drill core and lump materials. Buehler offers a complete solution for preparing ores and minerals either as a thin section*, a bulk mount or as a powder such as mineral tailings. Each preparation method is dependent on the type of material, examination method and starts with proper sample sectioning and mounting.

**See "Guide to Petrography" for information on preparing thin sections*

Buehler offers a 24" (61cm) Lapro® Slab Saw for large samples and Trim Saws (shown) for serial sectioning chips.



Preparing a specimen begins with removing a representative sample from the bulk material. Proper sectioning minimizes cutting defects or damage and establishes a planar surface. Sectioning can induce irreversible damage; this is especially true when sectioning brittle and poorly consolidated materials.

It is recommended to impregnate brittle samples by filling pores and cracks. Dyes can be mixed with epoxy to highlight the impregnated areas which provide easy observation under the microscope. Powders, such as mineral tailings, can agglomerate so it is important to entirely coat each particle. Proper mounting and impregnation minimizes sample pull out, and is necessary for representative population of the sample which can affect mineralogy results.



IsoMet® Saws

IsoMet® 4000 & 5000 series includes:

- SMARTCUT System Prevents Sample and Machine Damage, Very Useful for Various Hardness Materials
- Built-in Micrometers for 1-2µm Precision Sample Positioning
- 8 (203mm) Blade Capacity
- Metric or Imperial Units
- Heavy Duty Cast Aluminum Base
- Adjustable Automatic Sample Cutting Length
- 55-method Programmability on the IsoMet® 5000

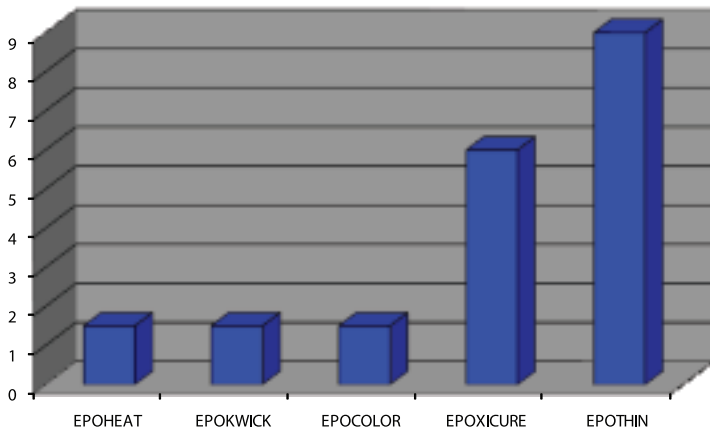
TIP

Petrographic blade for cutting minerals, rocks and ceramics used in the IsoMet 4/5k saw is 15LC.

Recommend optional saw accessory:

General Usage Vise #11-2691 which holds up to 1.75" H x 2" D (45mm x 50mm) samples. Mounting vices for cylindrical mounts and irregular specimens are also available.

Resin Cure Times Comparison
CURE TIME (IN HOURS)



Choosing a castable mounting resin is based on several variables but it is important to take into consideration the type of samples and their preparation. For polished thin sections and ultra-thin sections, low viscosity epoxies **EpoThin®** or **EpoxiCure®** are recommended due to their excellent infiltration of pores and cracks. Both epoxy resins have a refractive index which is closest to glass on which the samples are mounted. It's important when viewing these samples on an optical microscope with reflected, transmitted, and fluorescent light capabilities the epoxy will not scatter the light and distort the image.

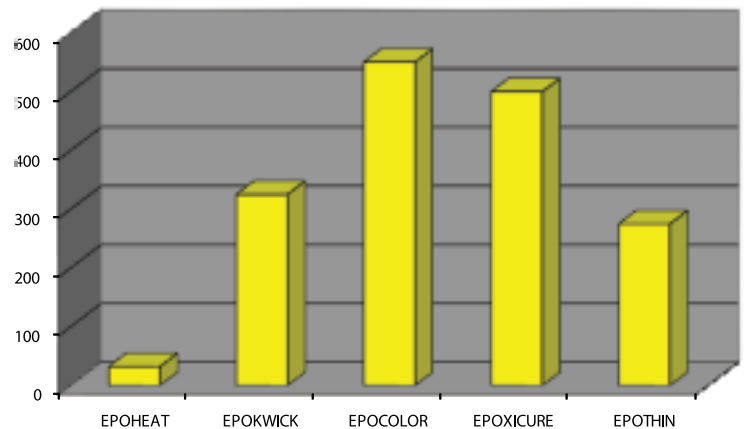


EpoHeat® is excellent for encapsulation and/or impregnation and is recommended for SEM mounts, since it has the least amount of off gassing and because of its fast curing time of less than 2 hours. EpoHeat® does require oven curing.

To view a video on the proper preparation of EpoHeat®, please visit: <http://www.buehler.com/epoheathto.htm>.

Viscosity Comparison Chart

VISCOSITY (MIXED, IN CPS)



Castable Mounting Compounds Comparison Chart

	Cure Time	Peak Temp. °C / °F	Refractive Index @ 0° C **	Viscosity cps	For Thin Sections or Bulk Mount	Vacuum Impregnation Recommended
EpoHeat®*	90 mins.	146 / 295	1.5732	32 @ 25°C	Bulk	Y
EpoThin®	9 hrs.	27 / 80	1.5702	200-350 @ 25°C	Thin & Bulk	Y
EpoxiCure®	6 hrs.	28 / 82	1.5615	400-600 @ 25°C	Thin & Bulk	Y

*Recommended for SEM mounts and requires oven curing. Not recommended for heat sensitive materials.

**Per ASTM D 542-95, epoxy thickness 0.0125" (0.3175mm)



Cast N' Vac 1000

Easy To Use:

- Place specimen molds on the rotating turntable within the vacuum chamber.
- After the mounting compound is mixed, slide the mixing cup into the cup holder.
- Place the vacuum chamber cover onto the base.
- Pump down to the recommended vacuum of 26Hg. (559 Torr).
- Pour the mounting compound into the mold and then use the control switch to advance the rotary table to the next mold.
- Once cast, hold for one minute, then vent to atmospheric pressure; repeat the cycle several times.
- Release pressure, open the chamber; remove the mounts and allow normal curing.

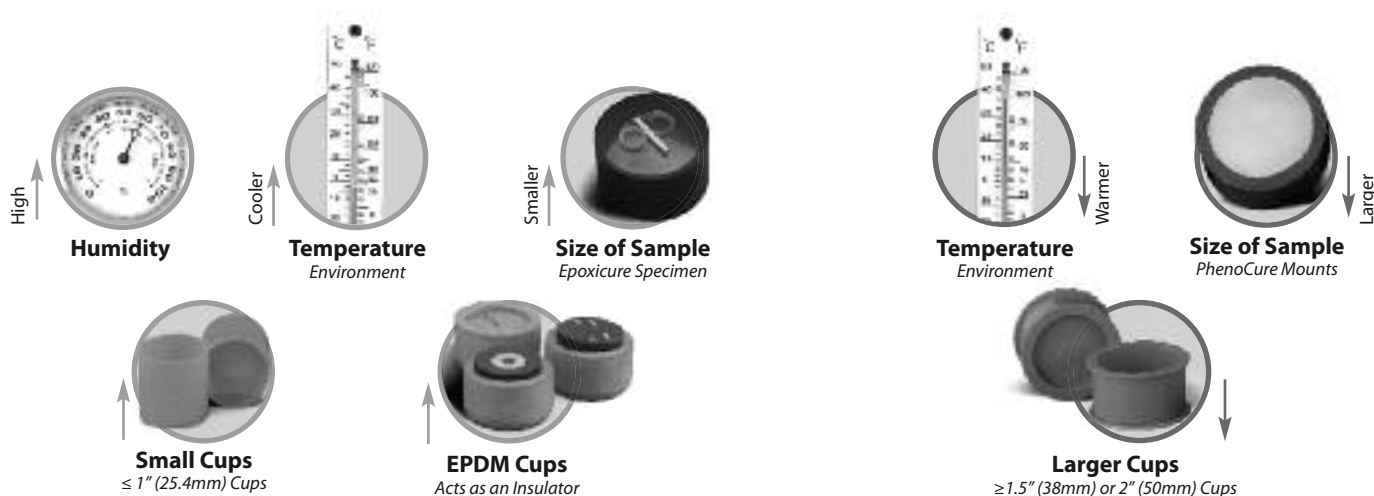
The Cast N' Vac for single sample preparation is available.

Once sectioned, encapsulation and impregnation begins with a low viscosity epoxy under a vacuum to remove gasses from pores or cracks and fill them with epoxy, thus providing sample integrity. The **Cast N' Vac 1000** Vacuum Impregnation System evacuates trapped air from castable mounting materials. For powders (and mineral tailings), great care must be taken to insure a highly polished sample and techniques vary slightly for coarse or fine particulate. Segregation of particles must be minimized otherwise analysis results will be biased. If segregation occurs due to the varying mineral densities of particles, it may be necessary to mount the powder, section it in half, and remount it exposing the cut surface with varying particle densities.



To easily distinguish pores and crack with a microscope, EpoColor epoxy may be used.

Factors That Affect Time of Cure (Up Arrows Indicate a Longer Cure Time)

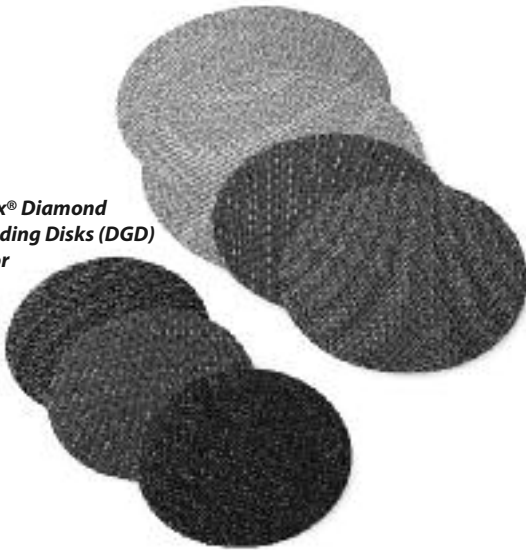


Grinding and polishing of specimens involves the use of abrasive particles sequentially with finer grinding media in a series of steps removing preparation damage and surface irregularities until a smooth, perfectly flat matt-finished surface is achieved. Grinding is accomplished by using diamond or SiC abrasives in a water, solvent, or oil-based carrier on a rotary grinder polisher. In transition between abrasives to the next grit size, the surface should be cleaned to remove any ground material and loose particles generated from coarse grinding.

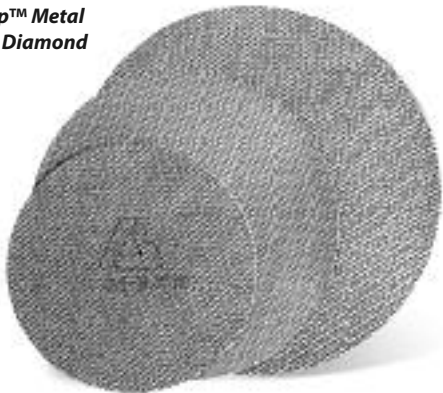


The Ultramet® Ultrasonic cleans your specimens and holder between preparation steps minimizing contamination and removing any loose debris.

Apex® Diamond Grinding Disks (DGD) Color



UltraPrep™ Metal Bonding Diamond Discs



Silicon Carbide (SiC), fixed, in **CarbiMet® 2** Abrasive Grinding paper and **BuehlerMet® II** papers are designed for superior performance. SiC grinding papers can be used for all types of minerals and ores and provide superior surface finish for soft and sensitive materials such as copper, pyrites and other sulfide minerals.

Buehler offers fixed abrasives which are bonded to a substrate giving specific advantages. A fixed resin bonded abrasive, **Apex® Diamond Grinding Disks (DGD) Color** can be used for coarse grinding and is ideal for automated grinder polishers like the **BuehlerVanguard® 2000**. Diamond abrasive will resist more aggressive fracturing and abrades faster than any other abrasive. **UltraPrep™ Metal Bonded Diamond Discs** are PSA backed and are available with resin or metal bonding. Both offer improved efficiency, superb specimen flatness with minimal edge rounding and fracture, and minimized surface relief essential for electron back scatter diffraction analysis (EBSD).



Premium Polishing Cloths & Pads

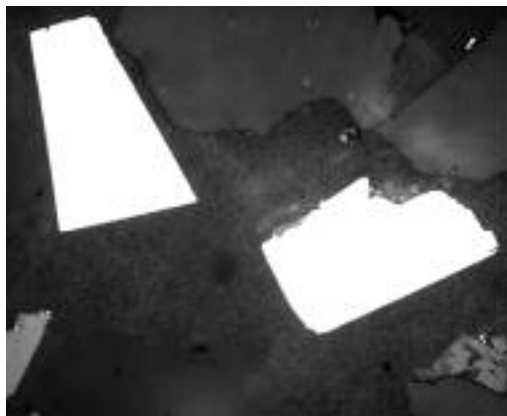
Premium Cloths	Recommended Micron Size	Abrasive Type	Cloth Characteristics	Usage Guide
TexMet® or TexMet® (MB) Magnetic Backed	15-3	Diamond, Al ₂ O ₃	Non-woven Pad for Surface Finish	A Firm Dense, & Hand Polishing Cloth Disc with Excellent Uniformity
TexMet® P	15-3	Diamond,	Hard Perforated Non-woven Pad	
TriDent™	15-1	Diamond	Softer, Durable, Woven Synthetic, No Nap	Used to Maximize Flatness and Retain Phases while Providing Excellent Surface Finish
MicroCloth®	5-0.02	Diamond, Al ₂ O ₃ , SiO ₂	Synthetic Cloth with Medium Nap	Most Popular General Usage Final Polishing Cloth



Additional information on the TexMet® Polishing Pads is available at: <http://www.buehler.com/textmet.htm>



Galena specimen with plucking



Galena specimen properly prepared without plucking or pullout

A suitable polishing cloth holds an abrasive, offers long life, and has the proper hardness/softness, which varies by the height of nap (fiber). Choosing a cloth depends on the material being prepared and varies by fabric, weaves or type of nap. As a general rule, a hard polishing cloth that does not have a nap will minimize surface relief. Inversely, soft cloths that have a nap control scratches and will provide a better surface furnish. Grinding media can be applied in either paste, aqueous suspension, or oleophilic suspension depending on mineral sensitivity.

TIP

During polishing it is very important, especially with minerals, to keep the cloth moist in order to prevent specimen pullout.

Buehler offers a full line of grinder polishers from semi-automatic to fully automatic. The **EcoMet® AutoMet®** Grinder Polisher Family bench top units, 8 – 12” diameter platens, are available with membrane or touch-screen controls, Pro versions have programmable preparation methods and Z-axis material removal. All the Pro units have automatic abrasive dispensing systems available. A complete list of features is listed in the Grinding / Polishing Equipment Comparison Chart.



A short video on the EcoMet / AutoMet Grinders is available at:
<http://www.buehler.com/ecomet250.htm>
http://www.buehler.com/Video_EcoMet_Pro.htm

Grinding/Polishing Equipment Comparison Chart

		EcoMet® 250	EcoMet® 250 Pro	EcoMet® 300 Pro (Most Powerful)	Buehler Vanguard® Automated
Platen Wheel Size	8" (200mm)	■	■		■
	10" (250mm)	■	■		
	12" (300mm)			■	
Platen Quantity	Single	■	■	■	
	Six				■
Controls	Membrane Keypad	■			■
	LCD	■			
	Touch-Screen		■	■	■
Method Programmability*	Yes		■	■	■
Z-axis Material Removal*	Yes		■	■	
Preparation Type*	Manual (w/o AutoMet®)	■	■	■	
	Semi-Automatic	■	■	■	
	Automatic				■

Buehler's EcoMet® / AutoMet Pro Grinder-Polisher utilizes state-of-the-art color touch-screen controls. Additional capabilities include Zaxis, material removal by depth system, method(s) storage, and single and central force capabilities.

* With Power Head



Buehler's Vanguard 2000 Fully Automatic Preparation System is ideal for the automated mineralogy laboratory that requires high volume sample preparation.

Preparation Method: Sulfide Mineral 45 micron Size

	Surface	Lubricant	Abrasive Size/Type	Time Min., Sec.	Force Per Sample N/lb	Head Speed, Rotation	Base Speed
Grinding	(DGD) Color Diamond Grinding Disc	Water	15 µm Diamond MetaDi®	until plane	22/5	60 rpm, contra	100 rpm
	(DGD) Color Diamond Grinding Disc	Water	6 µm Diamond MetaDi®	5:00	22/5	60 rpm, complimentary	100 rpm
Polishing	TexMet®	MetaDi® Fluid	3 µm Diamond MetaDi®	5:00	22/5	60 rpm, complimentary	100 rpm
	MasterTex®	MasterMet®	0.06 µm amorphous SiO ₂	5:00	22/5	30 rpm, complimentary	100 rpm

Note: A general method which would vary depending on sample hardness.

For additional information on all of Buehler products and Petrographic accessories, please visit: www.buehler.com or consult your nearest Buehler sales engineer. Buehler continuously makes product improvements; therefore, technical specifications are subject to change without notice.

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