

Mold Polishing: MoldMAX® & PROtherm®

Polishing of plastic mold tooling requires special skills involving a variety of abrasives, tools, and equipment. Polishing procedures vary from shop to shop and from one craftsman to another. The purpose of this TechBrief is to provide general guidelines on mold polishing based on principles developed in producing the required surface finish on MoldMAX & PROtherm.

ANALYSIS OF THE PROJECT

Determine the final surface finish/polish requirements of the mold. Examine the surface condition of the mold produced by the last machining operation before beginning polishing. Determine the polishing sequence for the most economical way of producing the needed surface finish.

TYPICAL POLISHING SEQUENCE

The sequence of mold polishing is determined by the surface condition produced by various mold manufacturing methods, including milling and electrical discharge machining (EDM).

Rough Grinding

Carefully inspect machined surface for any rough spots. Remove any high spots with a cartridge wheel containing an emery paper wrapped around a mandrel and mounted on a shank. Filing is not recommended.

Fine Grinding

Begin stoning using “soft stones” containing Aluminum Oxide. Stoning must be performed wet with mineral lubricants. Perform the first stoning using hand tools with 320 grit stone, followed by the higher grade 400 grit and 600 grit stones. Stoning must be done in the direction of ejection to create a draw finish.

Final Polishing

Begin diamond polishing with #15 diamond compound, followed by #6 and finished with #3 diamond compound. For optical quality finish, polish with #1 diamond compound.

Polishing Hints for Diamond Finish

- ⇒ An oil soluble diamond compound is preferred.
- ⇒ A thinning oil which serves as a lubricant can be used

during diamond polishing.

⇒ A wide variety of tools are used for application of diamond compounds. In addition to brushes and felts, different types of wood (e.g., hard maple wood, balsa wood) serve as laps to develop the final finish required on the mold surface.

⇒ Light pressure must be applied during diamond polishing so as not to produce a burnishing effect.

SPECIAL POLISHING CONSIDERATIONS

EDM'ed Surfaces

Mold cavities and cores may contain small pits resulting from EDM. Emery papers or abrasives with widely spaced grit are recommended to eliminate these pits.

Welded Surfaces

A mold containing a repair welded surface is often soft at this location compared to the base metal. Care must be taken to avoid formation of sink marks along this soft zone. Flat lapping using a broad stone is recommended to eliminate this surface defect.

Textured Surfaces

A great variety of decorative effects on the surfaces of a mold may be produced by different mold finishing processes. Typical examples of such surfaces include handle grips, leather grain, matte surfaces, etc. They can be produced by acid etching from the type of texture selected from master samples.

MOLD FINISH STANDARDS

The surface finish standards on molds is often specified by the SPI-SPE Mold Finish Comparison Kit. It consists of six steel disks polished to different levels. The polishing

technique employed to obtain the six different mold finishes, and the surface roughness measured in RMS microinches are shown in Table 1.

POLISHING DEFECTS, CAUSES AND REMEDIES

Defect: Orange Peel.

Cause(s): This surface irregularity results from overpolishing or polishing with too much pressure.

Remedy: Polish by hand to remove the defective surface by a stone with grit size finer than the last grit used.

Defect: Pitting.

Cause(s): Pitting is not commonly observed in MoldMAX & PROtherm. Generally, small pits occur in a polished mold surface when hard nonmetallic inclusions are dislodged from the surface during polishing.

Remedy: Apply light pressure during polishing. Avoid polishing in excess of that which is required to remove marks made by the preceding grit. Select clean mold materials to minimize the number of inclusions.

SAFE HANDLING OF COPPER BERYLLIUM

Please refer to the Materion Corporation publications “Safety Facts 102 - Safety Practices for Sanding, Grinding, Buffing, Lapping And Polishing Copper Beryllium Alloys”, and “Safety Facts 105 - Processing Copper Beryllium Alloys.”

Handling copper beryllium in solid form poses no special health risk. Like many industrial materials, beryllium-containing materials may pose a health risk if recommended safe handling practices are not followed. Inhalation of airborne beryllium may cause a serious lung disorder in susceptible individuals. The Occupational Safety and Health Administration (OSHA) has set mandatory limits on occupational respiratory exposures. Read and follow the guidance in the Material Safety Data Sheet (MSDS) before working with this material. For additional information on safe handling practices or technical data on copper beryllium, contact Materion Brush Performance Alloys, Technical Service Department at 1-800-375-4205.

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Finish Number	Polishing Technique	Surface Roughness (RMS)	
		microinches (µin)	microns (µm)
1	#3 Diamond Polish	0.5 to 1.0	0.013 to 0.025
2	#15 Diamond Polish	1.0 to 2.0	0.025 to 0.051
3	320 Grit Abrasive Cloth	7.0 to 7.5	0.18 to 0.19
4	280 Grit Abrasive Cloth	12.0 to 15.0	0.30 to 0.38
5	240 Grit, Dry Blast (5 inch distance @ 100 psi) (12.7 mm distance @ 689 KPa)	26.0 to 32.0	0.66 to 0.81
6	24 Grit, Dry Blast (3 inch distance @ 100 psi) (7.6 mm distance @ 689 KPa)	160.0 to 190.0	4.1 to 4.8

Table 1. The SPI-SPE Mold Finish Comparison Kit