

FINISHES

Parts built off DMLS machines have a raw finish comparable to a fine investment cast, with a surface roughness of approximately 350 R a- μ inch or R a- μ m 8.75, or a medium turned surface. This surface roughness can be improved up to 1 R a- μ inch or R a- μ m 0.025, a super mirror finish. There are several processes available to achieve the desired surface finish.

Shot Peening

Shot peening is a process used to produce a compressive residual stress layer and modify mechanical properties of metals. It entails the use of media to impact a surface with sufficient force to create plastic deformation. It is similar to blasting, except that it operates by the mechanism of plasticity rather than abrasion. Peening a surface spreads it plastically, causing changes in the mechanical properties of the surface. Depending on the part geometry, part material, shot material, shot quality, shot intensity, and shot coverage, shot peening can increase fatigue life from 0–1000%. Shot peening is used primarily for foundries for deburring or descaling surfaces in preparation for additional post-processing.

Electrochemical Polishing

Electrochemical polishing also referred to as electro polishing, is an electrochemical process that removes material from metal parts through polishing, passivation, and deburring. It is often described as the reverse of electroplating; differing from anodizing in that the purpose of anodizing is to grow a thick, protective oxide layer on the surface of a material rather than polish. The process may be used in lieu of abrasive fine polishing in micro structural preparation, and is an inexpensive option for DMLS projects that are not tolerance dependent, creating a bright uniform finish. The extent to which electro polishing is successful depends upon the degree of preparation of the treated surfaces.

Abrasive Flow Machining (Extrude Hone) Polishing

Abrasive flow machining (AFM), also known as extrude honing is a method of smoothing and polishing internal surfaces and producing controlled radii. A one-way or two-way flow of an abrasive media is extruded through a workpiece, smoothing and finishing rough surfaces. One-way systems flow the media through the workpiece, then it exits from the part. In two-way flow, two vertically opposed cylinders flow the abrasive media back and forth. The process is particularly useful for difficult to reach internal passages, bends, cavities, and edges. This is an inexpensive option for DMLS projects that are not tolerance dependent, and a more uniform surface roughness. The extent to which AFM is successful depends upon the degree of preparation of the treated surfaces.

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Optical Polish (Hand Finishing)

When projects have geometries in low quantities that are not tolerance dependent, the best finishing option is an optical polish. Optical polishes are extremely cost effective, and the best way to achieve a brilliant finish. Due to surface porosity of DMLS metals, .003" to .010" of surface material is removed depending upon geometry. If this option is desired, it is imperative that designers or engineers consult with GPI prior to building, as specific surfaces may need to be offset with additional material to ensure part integrity after post-processing. Optical polishing is not ideal for large batches as it lends itself to an inconsistent finish from part to part.

CNC Finishing/Machining

CNC finishing permits high quality contoured milling applications to achieve tight tolerances. Detail-oriented precision can be accomplished with 3-axis, 5-axis and 6-axis CNC lathes. Conventional fixed headstock and Swiss-style CNC lathes can be utilized to support complex operations such as cross drilling and cross tapping, cross milling and slotting, C-axis milling and off-center work. Proper fixturing can yield tolerances as tight as 1 micron or (.00004). Should this post processing option be desired, pre-build planning is required to add sufficient material to machined features and surfaces so that tolerances can be met.

Information supplied courtesy of GPI Prototypes and Manufacturing Services Inc. (Chicago, Ill)