

CRAFTSMAN CRIBSHEET

3D Printing Technology for the Shop

By David Wynn, Director of Technical Services & Industry Affairs, PMPA

Below is a basic breakdown of various 3D printing technologies and how they relate to work in our shops. The breakdowns are to represent a broad category of methods at a high level. A more granular analysis would illustrate each category that can vary greatly in applicability and method. There are various new technologies that may differ from these descriptions and in some cases combine multiple methods mentioned below.

FDM — Fused Deposition Modeling

When most people think of 3D printing, they think of fused deposition modeling (FDM). Typically, a spool of plastic is fed through a nozzle depositing one layer at a time. FDM is a great method for making larger prints. It also has the capability to make hollow or honeycomb-formed interiors. Printing hollow can reduce weight without compromising strength. Hollow prints can also reduce the amount of material used on large prints. Final print tolerances of around ± 0.015 - 0.030 " are typical. PLA (polylactic acid) has good chemical resistance and can hold up well in the shop. I have used PLA for fixtures, gage holders, collet holders and other items that have encountered solvents, coolants and oils with no part deformation.

Uses. Fixtures (low tolerance), gage holders, collet racks, general purpose replacement for plastic containers.

Common materials. PLA, TPU (thermoplastic polyurethane) and ABS (acrylonitrile butadiene styrene).

Resin Printing

Printing is performed by dipping a plate into resin

and which is hardened using UV light. Resin printing works best when printing highly detailed tight tolerances prints. Even with cheap resin printers (<\$500) I have achieved tolerances of ± 0.005 " on prints. I have even held ± 0.002 " on some critical dimensions when proper care is taken. Because of the accuracy of resin, it can be used to make lower tolerance test parts.

Uses. Test part prints, jigs, fixtures, customer ejectors, robot grippers, vice jaws and more.

Resins are mostly proprietary to manufacturers. They are typically defined by final properties.

Common materials. Detail resin, flexible resin, heat resistant resin, tough resin and imitation ABS.

Powder Bed Printing

Powder printing has been around for a while but has typically been only available for high-end printers. There are several hobby/prosumer printers available for under \$4,000. The raw material is a powder which is fused together with heat or a chemical binder. In general, parts must be post processed to complete the part. Typically, loosely bound material (green part) will be heat treated and washed to reach the finished part. Metal can be printed using this method. Prints can also be hollow like FDM. Tolerances ± 0.015 " can be achieved but dimensional change during heat treatment can make tight tolerances challenging.

Uses. Same as the other methods but with added materials including metals.

Common Materials. Plastics, metals, polymers and ceramics. **P**

