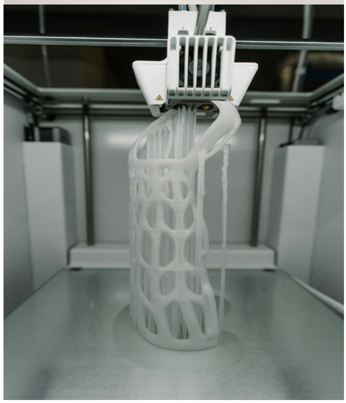
Formech

Guide

A Guide to 3D Printing Materials for Vacuum Forming



FFF (Fused Filament Fabrication) and FDM® (Fused Deposition Modeling) are essentially the same 3D printing technology and the most commonly used. Both build 3D objects by extruding melted thermoplastic filament layer by layer. FDM is a trademarked term by Stratasys.

Material	Properties	Notes for Vacuum Forming
ABS (Acrylonitrile Butadiene Styrene)	Strong, heat-resistant, can be smoothed with acetone	Better suited for vacuum forming tools than PLA
ASA (Acrylonitrile Styrene Acrylate)	UV resistant, weatherable, similar to ABS	Suitable for outdoor applications and moderate heat
Carbon-Fibre Reinforced Filaments	Stiffer and more heat-resistant variants of base polymers	Ideal for strong, durable tooling (eg, CF-nylon)
Nylon (Polyamide)	Flexible, strong, wear-resistant	Needs drying before printing; moderate heat tolerance
PC (Polycarbonate)	Very strong, high heat resistance	Requires high-temp printer and enclosure; great for heat-resistant tools
PETG (Polyethylene Terephthalate Glycol)	Durable, food-safe, easy to print	Good for low-to-moderate temperature forming
PLA (Polylactic Acid)	Easy to print, biodegradable, low warping	Low heat resistance - not ideal for repeated vacuum forming
TPU/TPE (Flexible Filaments)	Rubber-like flexibility	Not suitable for rigid vacuum forming tools

SLA (Stereolithography) and DLP (Digital Light Processing) are both resin-based 3D printing technologies, but they differ in how they solidify the liquid resin. SLA uses a laser to trace each layer, while DLP uses a digital light projector to cure an entire layer at once. DLP is generally faster, while SLA is known for producing higher precision and smoother surface finishes. They have a tendency to warp.

Material	Properties	Notes for Vacuum Forming
Standard Resin	High detail, brittle	Not suitable for heat applications
Tough Resin	Higher strength and impact resistance	May be usable for limited vacuum forming
High-Temp Resin	Heat-resistant (up to 238–289°C)	Good for short runs and prototyping vacuum forming tools
Flexible Resin	Rubber-like finish	Not applicable for tooling
Ceramic-Filled or Engineering Resins	Rigid, sometimes heat-resistant	Expensive but suitable for functional parts

Here are some example industrial and advanced materials used in 3D printing.

SLS (Selective Laser Sintering) and MJF (Multi Jet Fusion) are both powder-based 3D printing technologies.

ULTEM, also known as PEI (Polyetherimide), is a high-performance thermoplastic that offers excellent strength, high temperature resistance, and chemical resistance.

PEEK (Polyetheretherketone) and PPSU (Polyphenylsulfone) are both high-performance thermoplastics known for their excellent thermal and mechanical properties.

DMLS (Direct Metal Laser Sintering) and DMLM (Direct Metal Laser Melting) are essentially the same metal 3D printing technology where a high-powered laser melts and fuses powdered metal layer by layer to build three-dimensional objects.

Material	Properties	Notes for Vacuum Forming
Nylon PA11 / PA12 (SLS/MJF)	Durable, heat-resistant, flexible	Excellent for porous tools - often used for vacuum forming
Ultem (PEI)	Extremely heat-resistant, aerospace-grade	Expensive but ideal for high-performance needs
PEEK and **PPSU** (Polyetheretherketone and Polyphenylsulfone)	High-performance thermoplastics, excellent thermal and mechanical properties	Rarely used outside industrial applications due to cost/printer requirements
Metal (DMLS, DMLM, etc)	Similar properties to machined metals	Expensive, can be porous, size restrictions

Material	Properties
PETG, ABS, or PC (FFF)	Good balance of strength and heat resistance
Nylon PA12 (SLS/MJF)	Naturally porous, great for vacuum distribution
High-Temp Resin (SLA)	Suitable for prototypes and short runs
Carbon-Fibre Reinforced Nylon	Strong and dimensionally stable under heat

Final Notes

- When designing tools specifically for vacuum forming, aim for high-temp resistant, low-warping, and possibly porous materials
- Always avoid PLA for anything beyond a quick prototype
- 3D printing materials are evolving and advancing quickly
- Some proprietary materials can be a great option for vacuum forming but should be evaluated before use

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