Polymer Additive Manufacturing Technology

FAST RADIUS®

		VAT POLYMERIZATION		POWDER BED FUSION		MATERIAL EXTRUSION	MATERIAL JETTING	BINDER JETTING
		SLA	DLS	SLS	MJF			
	Industry applications	Prototyping, dental, jigs / fixtures, jewelry	Automotive, medical, dental, industrial, CPG	Automotive, medical, industrial, CPG	Automotive, medical, industrial, CPG	Aerospace, prototyping, jigs / fixtures, industrial	Prototyping, overmolds, medical models, jewelry	Prototyping, sand casting
MATERIAL	Material types	Thermoset, ceramic	Thermoset	Thermoplastic	Thermoplastic	Thermoplastic, composite	Thermoset	Ceramic (sand)
	Environment / certification	N/A	UV, chemical, flame (HB)	UV, chemical, flame (V-0)	UV, chemical, flame (HB)	UV, chemical, flame (5-VA)	N/A	N/A
	Material options	Many	Many	Limited	Limited	Many	Several	Limited
	Isotropy	Isotropic	Isotropic	Isotropic	Isotropic	Anisotropic	Anisotropic	Anisotropic
	Multi-material printing	✗	✗	✗	✗	✓	✓	✗
ECONOMICS	Process type	Batch	Batch	Batch	Batch	Single piece	Single piece	Batch
	Process design / NRE required	Significant	Significant	Minimal	Minimal	Medium	Medium	Minimal
	Recommended part size	Tennis ball to golf ball	Tennis ball to golf ball	Softball	Softball	Softball	Tennis ball	Softball
	Throughput / annual volume	Medium	High	High	High	Low	Low	Low
SURFACE	In-process color	In-process (single color)	In-process (single color)	N/A	In-process (multicolor)	In-process (single color)	In-process (multicolor)	In-process (multicolor)
	As-built texture	Smooth	Smooth	Rough, uniform	Rough, uniform	Layer lines	Smooth	Rough, uniform
DESIGN	Support material required	✓	✓	✗	✗	✓	✓	✗
	Minimum feature size	XS S M	XS S M	XS S M	XS S M	XS S M	XS S M	XS S M

Vat polymerization

STEREOLITHOGRAPHY (SLA)

SLA uses light to create parts in a pool of UV-curable resin by selectively solidifying the layers on a build platform. The light is focused very finely in a laser, so this method can produce an exceptional surface finish. It's good for high-resolution parts with a limited lifespan and mechanical load.

Industry applications	Prototyping, dental, jigs / fixtures, jewelry
Material types	Thermoset, ceramic
Environment / certification	N/A
Material options	Many (high temperature, clear, castable, dental)
Isotropy	Isotropic
Multi-material printing	No
Process type	Batch
Process design / NRE required	Significant
Recommended part size	Tennis ball to golf ball
Throughput / annual volume	Medium (1,000s)
Part color	In-process (single color), post-finishing *Exact color-matching not available
As-built texture	Smooth
Support material required	Required, tear-away
Minimum feature size	Extra small
Benefits: Very fine features; specialty materials for dental, jewelry, etc.	

DIGITAL LIGHT SYNTHESIS (DLS)

Digital Light Synthesis (DLS) is a proprietary technology from Carbon®. The process uses digital light projection, oxygen-permeable optics, and liquid resins to produce parts with excellent mechanical properties, resolution, and surface finish. It's good for a wide range of applications including automotive, dental, industrial, medical, and consumer goods.

Industry applications	Automotive, medical, dental, industrial, CPG
Material types	Thermoset
Environment / certification	UV, chemical, flame (HB, V-0)
Material options	Many (high temperature, elastomers, epoxies, polyurethanes)
Isotropy	Isotropic
Multi-material printing	No
Process type	Batch
Process design / NRE Required	Significant
Recommended part size	Tennis ball to golf ball
Throughput / annual volume	High (10,000s)
Part color	In-process (single color) *Exact color-matching not available
As-built texture	Smooth
Support material required	Required, tear-away
Minimum feature size	Extra small / small
Benefits: Large material selection; long material life; injection molding-like finish; highly detailed; process has been validated, production-ready	

Powder bed fusion

SELECTIVE LASER SINTERING (SLS)

SLS technology uses a high-powered laser to sinter the surface of a powder bed in a two-dimensional pattern, then applies another layer of powder to build up the part in a vertical direction. SLS is ideal for producing parts with complex features that must still bear a mechanical load.

Industry applications	Automotive, medical, industrial, CPG
Material types	Thermoplastic
Environment / certification	UV, chemical, flame (V-0)
Material options	Limited (mostly nylons)
Isotropy	Isotropic
Multi-material printing	No
Process type	Batch
Process design / NRE required	Minimal
Recommended part size	Softball
Throughput / annual volume	High (10,000s)
Part color	Post-finishing
As-built texture	Rough, uniform
Support material required	Not required
Minimum feature size	Small / medium

Benefits: Vast design freedom (e.g., moving assemblies are possible); well-understood thermoplastics; process has been validated, production-ready

MULTI JET FUSION (MJF)

MJF is a proprietary technology from HP that utilizes fusing and detailing agents to apply a two-dimensional pattern on a bed of polyamide powder. High-powered lamps then heat and fuse the layer. This process repeats until the part is complete. Parts made with MJF don't require supports, and the high-density, low-porosity materials used in the process make it ideal for chemical resistance, complex assemblies, housings, enclosures, and watertight applications.

Industry applications	Automotive, medical, industrial, CPG
Material types	Thermoplastic
Environment / certification	UV, chemical, flame (HB)
Material options	Limited (mostly nylons)
Isotropy	Isotropic
Multi-material printing	No
Process type	Batch
Process design / NRE required	Minimal
Recommended part size	Softball
Throughput / annual volume	High (10,000s)
Part color	In-process (multicolor), post-finishing *Exact color-matching not available
As-built texture	Rough, uniform
Support material required	Not required
Minimum feature size	Small / medium

Benefits: Vast design freedom (e.g., moving assemblies are possible); well-understood thermoplastics; process has been validated, production-ready

Material extrusion

Material extrusion uses a heated nozzle to melt and deposit thermoplastics onto a build plate. While following a toolpath, the nozzle extrudes one layer at a time until the final part is created. This method usually has short lead times and creates cost-effective parts. Material extrusion can handle larger parts than many additive technologies and is ideal for creating everything from quick prototypes to final parts.

Industry applications	Aerospace, prototyping, jigs / fixtures, industrial
Material types	Thermoplastic, composite
Environment / certification	UV, chemical, flame (5-VA)
Material options	Many (high temperature, ABS, PEI, composites)
Isotropy	Anisotropic
Multi-material printing	Yes
Process type	Single piece
Process design / NRE required	Medium
Recommended part size	Softball
Throughput / annual volume	Low (100s)
Part color	In-process (single color), post-finishing
As-built texture	Layer lines
Support material required	Required, tear-away or soluble
Minimum feature size	Medium
Benefits: Well-understood thermoplastics, specialty materials (e.g., ULTEM); soluble supports enable design freedom; process has been validated, production-ready (aerospace certified)	

Material jetting

Material jetting deposits photopolymer drops onto a build plate in layers to create a part. The photopolymers are immediately cured with UV light as they're deposited to make the part solid. Material jetting works well for prototyping, overmolds, and models that require accuracy and good surface finishes.

Industry applications	Prototyping, jewelry, overmolds, medical models
Material types	Thermoset
Environment / certification	N/A
Material options	Several (rigid, elastomeric)
Isotropy	Anisotropic
Multi-material printing	Yes
Process type	Single piece
Process design / NRE required	Medium
Recommended part size	Tennis ball
Throughput / annual volume	Low (100s)
Part color	In-process (multicolor)
As-built texture	Smooth
Support material required	Required, soluble
Minimum feature size	Extra small
Benefits: Very fine features; multiple materials, colors are available within a single part	

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Binder jetting

Binder jetting deposits an adhesive onto thin layers of powder particles. Parts made with binder jetting don't require supports, and they can be printed in color. Binder jetting works well for aesthetic (non-mechanical) prototypes.

Industry applications	Prototyping, sand casting
Material types	Ceramic (sand)
Environment / certification	N/A
Material options	Limited (sandstone, sand, ceramic)
Isotropy	Anisotropic
Multi-material printing	No
Process type	Batch
Process design / NRE required	Minimal
Recommended part size	Softball
Throughput / annual volume	Low (100s)
Part color	In-process (multicolor)
As-built texture	Rough, uniform
Support material required	Not required
Minimum feature size	Small / medium
Benefits: Multiple colors available in a single print; large parts are possible	

FAST RADIUS

Ready to find the right additive manufacturing technology for your project?

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