

Description

Image



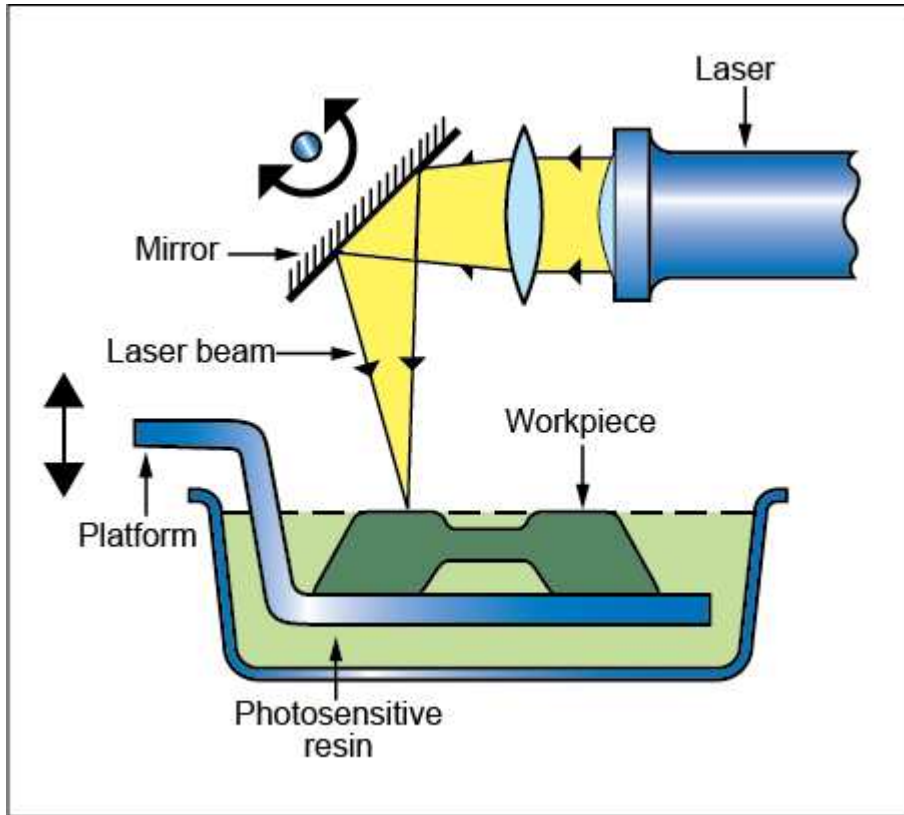
Image caption

(1) Materialise's Patented Mammoth Stereolithography Technology. © Materialise NV at Wikimedia Commons (CC BY 3.0) (2) Stereolithography parts assembled, a cycloidal drive. © Clemenspool at Wikimedia Commons (CC BY 3.0)

The process

STEREOLITHOGRAPHY (SLA) is the oldest and most widely used of the additive manufacturing systems. It is a vector scan process which uses a mirror to guide a UV laser to cure selected parts of a thin film of a photo-sensitive resin, building up a solid plastic object point-by point. When all points in one layer are complete, the part is lowered on a platform into the resin bath (typically by 0.1 mm) so that a new layer of liquid resin can be wiped across its surface. Cleaning followed by post-processing UV curing is needed to completely solidify the prototype. Fabricating an SLA part requires a CAD model of the part.

Process schematic



Material compatibility

Polymers - thermoplastics	✓
Polymers - thermosets	✓

Shape

Circular prismatic	✓
Non-circular prismatic	✓
Flat sheet	✓
Dished sheet	✓
Solid 3-D	✓
Hollow 3-D	✓

Economic compatibility

Relative tooling cost	low
Relative equipment cost	high
Labor intensity	high
Economic batch size (units)	1 - 10

Physical and quality attributes

Mass range	* 0.1 - 10	kg
Range of section thickness	0.5 - 100	mm

Tolerance	0.1	-	2	mm
Roughness	* 100	-	125	μm
Surface roughness (A=v. smooth)	C			

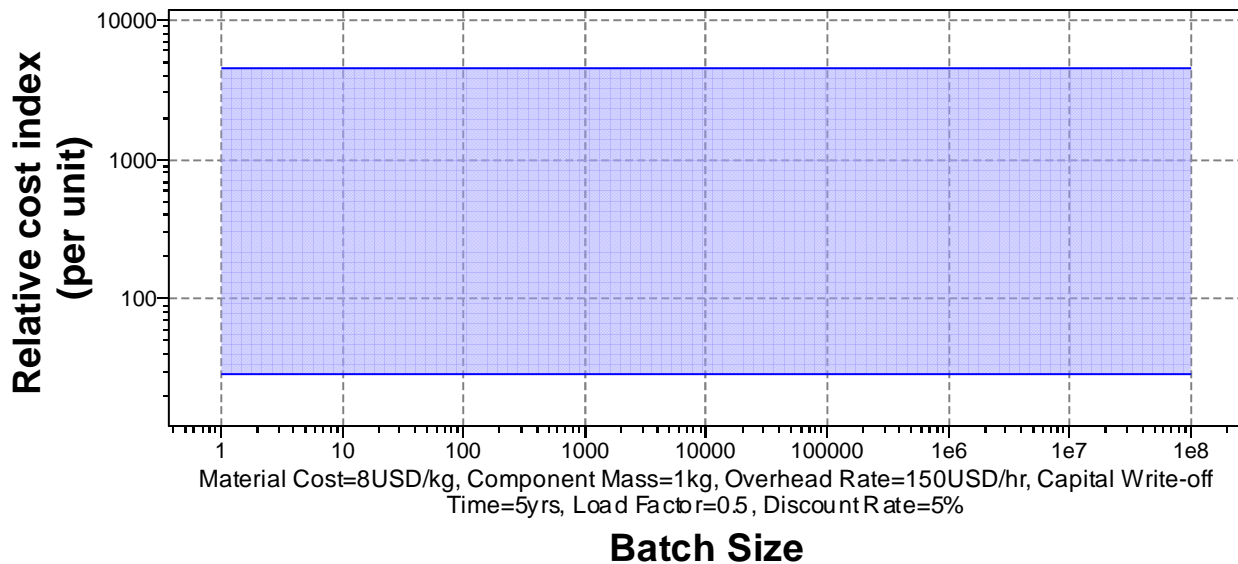
Process characteristics

Primary shaping processes	✓
Discrete	✓
Prototyping	✓

Cost model and defaults

Relative cost index (per unit)	* 28.5	-	4.46e3
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Parameters: Material Cost = 8USD/kg, Component Mass = 1kg, Batch Size = 1e3, Overhead Rate = 150USD/hr, Discount Rate = 5%, Capital Write-off Time = 5yrs, Load Factor = 0.5



Capital cost	2e3	-	1.04e6	USD
Material utilization fraction	* 0.5	-	0.7	
Production rate (units)	0.04	-	12	/hr
Tooling cost	0	-	0.1	USD
Tool life (units)	1e5	-	1e6	

Supporting information

Design guidelines

All shapes can be made. High complexity levels are possible, but support structures (which can later be removed) are required in addition to the main body of the object for overhangs. Good accuracy and surface finish and moderate mechanical properties are achievable.

Technical notes

The build envelope (L x W x H) ranges from 400 x 400 x 300 mm to 1500 x 750 x 550 mm.
Typical layer thickness is 25 - 150 μm .
Maximum scan rate is 3.5 - 25 m per second.

The process is relatively slow. Degradation when exposed to light can occur rapidly if UV protective coatings are not applied.

Typical uses

Making form and fit prototypes and models from CAD

The economics

Machine prices range from around \$1000 to

The environment

Photopolymers are thermoset materials and cannot be melted again for reuse. Care is needed with environmentally hazardous solvents used to clean up models. Direct exposure to the laser beam must be avoided. The resins are volatile, requiring good ventilation.

Links

MaterialUniverse

Reference