Description

Image



Image caption

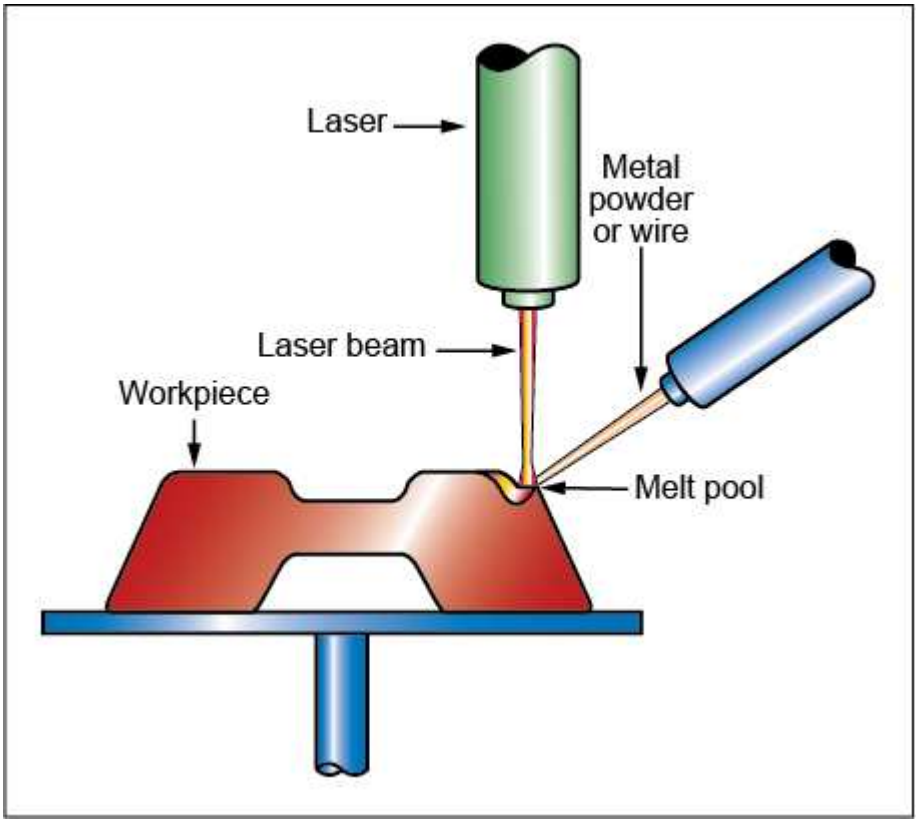
(1) Production of aerospace component using Laser Metal Deposition (LMD) technology © TWI Ltd at flickr (2) Production of aerospace component using Laser Metal Deposition (LMD) technology © TWI Ltd at flickr (3) Selective laser melting © TWI Ltd at flickr

The process

LASER POWDER FORMING (LPF) is an additive manufacturing technique in which wire or powder is fed into a melt pool created by a laser. The laser is scanned across the surface to add material to one layer at a time. When used as an alternative to machining from a block, a simple geometry is printed which requires milling to give the desired finish. As with other additive manufacturing processes, a CAD solid model of the part is used to create the code to guide the laser.

The process is also known as blown powder additive manufacturing, laser beam metal deposition, directed light fabrication, 3D laser cladding, laser generation, laser-based metal deposition, laser freeform fabrication, laser direct casting, laser consolidation or direct metal deposition. A variation on this method is wire fed plasma arc.

Process schematic



Tradenames

LaserCast, LasForm, Laser-Engineered Net Shaping (LENS)

Material compatibility

Metals - ferrous	✓
Metals - non-ferrous	✓

Shape

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

Economic compatibility

Economic batch size (units)	1	-	10	

Physical and quality attributes

Mass range	0.22	-	33.1	lb

Process characteristics

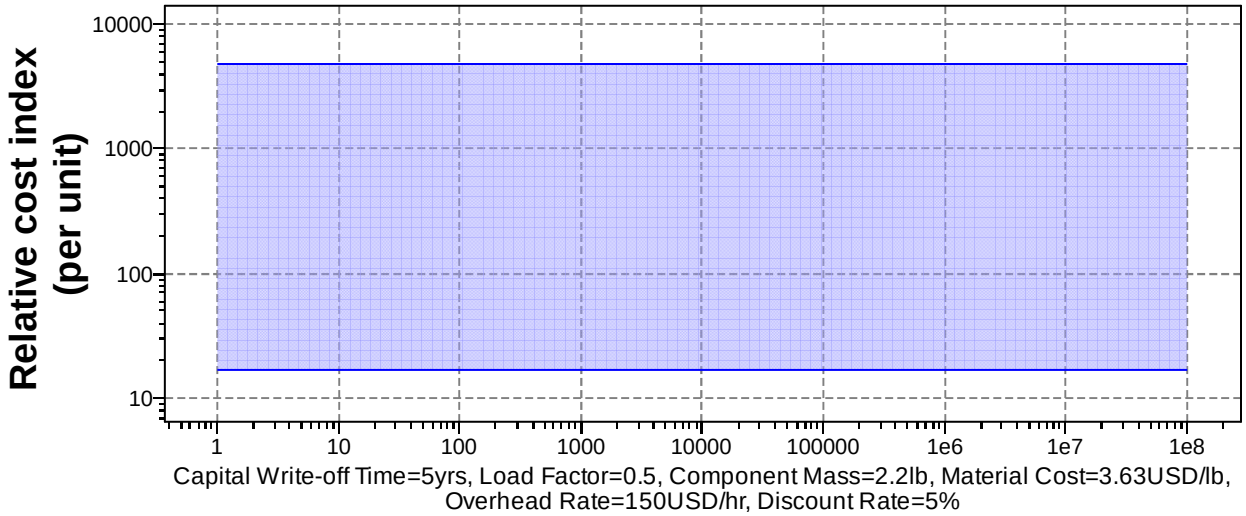
Primary shaping processes	✓

Discrete	✓
Prototyping	✓

Cost model and defaults

Relative cost index (per unit)	16.5	-	4.7e3

Parameters: Material Cost = 3.63USD/lb, Component Mass = 2.2lb, Batch Size = 1e3, Overhead Rate = 150USD/hr, Discount Rate = 5%, Capital Write-off Time = 5yrs, Load Factor = 0.5



Capital cost	5e5	-	8e5	USD
Material utilization fraction	0.8	-	1	
Production rate (units)	0.04	-	25	/hr
Tooling cost	0	-	0.1	USD
Tool life (units)	1e5	-	1e6	

Supporting information

Design guidelines

Requires support structures (which can be removed later) in addition to the main body of the object for some complex geometries such as overhangs. Produces fully dense objects suitable for immediate use.

Technical notes

The build envelope (L x W x H) ranges from 100 x 100 x 100 mm for jewelry and dentistry to 900 x 1500 x 900 mm.
Typical layer thickness is 250 - 1000 µm.
Material is added at a rate of around 16 - 320 cubic cm per hour.

Materials are processed in an inert gas chamber and must be available in either powder or wire form.

Typical uses

Fully dense functional parts in metals and ceramics such as: building ribs onto flat plates in aerospace industry, development of alloys, jewelry and dentistry. Repair and modification of existing structures to improve wear properties.

The environment

Direct exposure to the laser beam must be avoided. Excess powder can be reused if captured in a clean state and 100% feedstock efficiency if wire is used.

Links

MaterialUniverse

Reference