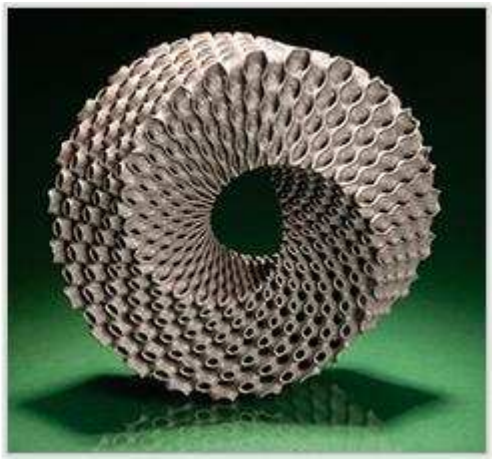
## Description

### Image



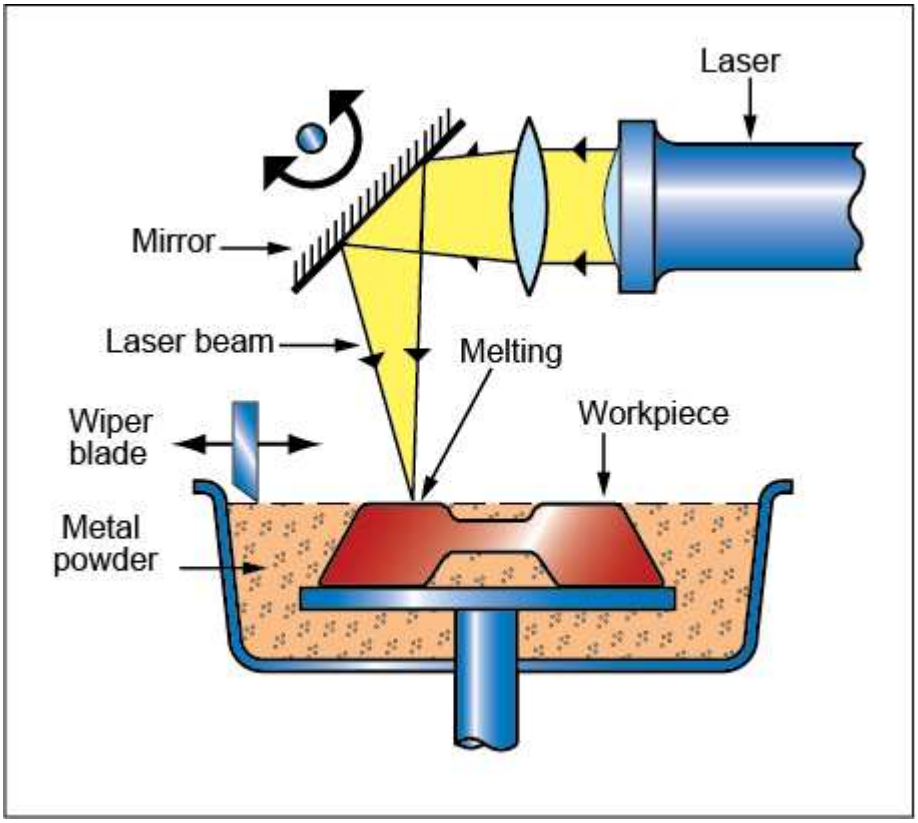
### Image caption

(1) Laser welding an automotive component © TWI Ltd at flickr (2) Mobius ring created using selective laser melting © TWI Ltd at flickr

### The process

SELECTIVE LASER MELTING (SLM) is a powder bed fusion technique. A laser beam is scanned across the surface, as with Selective Laser Sintering (SLS), but in this case it completely melts the powder locally to produce a fully dense model without the need for infiltration. As each layer is completed a new thin layer of powder is swept over the top by a wiper or milling head and the process repeated. Although analogous to EBM, the substrate is not heated so the temperature of the object increases during production. The result is an unusual microstructure unlike that of parts which have been cast. As with other additive manufacturing processes, a CAD solid model of the part is required.

### Process schematic




**Tradenames**

LaserCUSING

## 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 | - | 11 | lb |

## Process characteristics

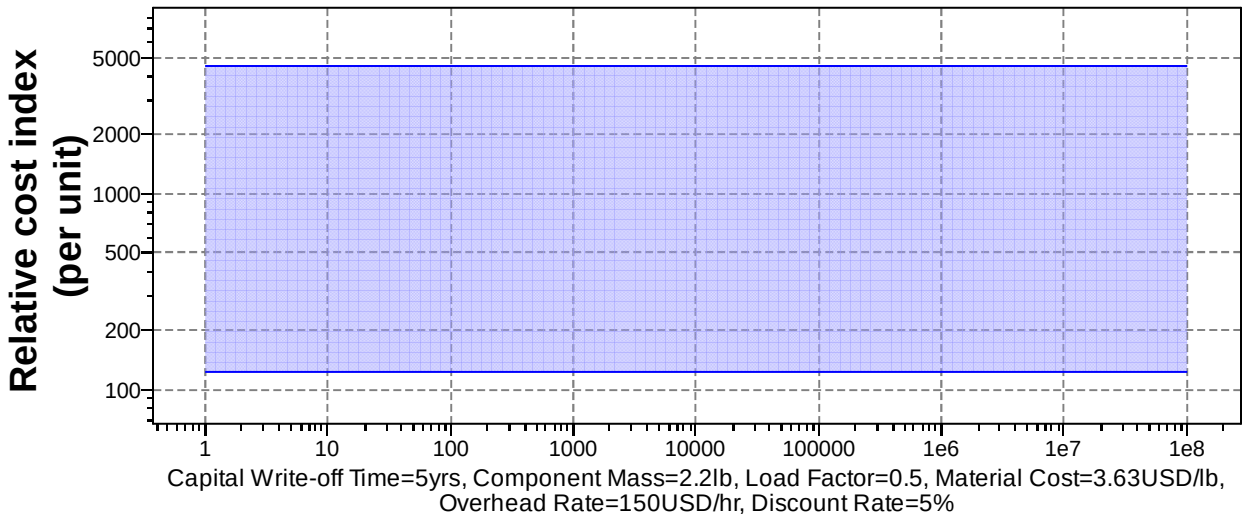
| | |
|---|---|
| Primary shaping processes | ✓ |

| | |
|---|---|
| Discrete | ✓ |
| Prototyping | ✓ |

## Cost model and defaults

| | | | |
|---|---|---|---|
| Relative cost index (per unit) | 121 | - | 4.45e3 |

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 | 4e5 | - | 5.5e5 | USD |
| Material utilization fraction | 0.75 | - | 0.85 | |
| Production rate (units) | 0.04 | - | 1.6 | /hr |
| Tooling cost | 0 | - | 0.1 | USD |
| Tool life (units) | 1e5 | - | 1e6 | |

## Supporting information

### Design guidelines

Does not require support structures to support overhangs so complex geometries can be produced with minimal wastage and machining.

### Technical notes

The build envelope (L x W x H) ranges from 50 x 50 x 80 mm for medical, dental and jewelry applications to 630 x 400 x 500 mm.
Typical layer thickness is 20 - 100 µm.
The object is built at a rate of around 5 - 20 cubic cm per hour.

Metals must be available in powder form. Operates in an inert atmosphere.

### Typical uses

The process is generally used for injection molding and die-cast tooling for the aerospace and automotive industries. It is also used for medical, dental and jewelry applications.

### The economics

Powder bed fusion is the most expensive type of additive manufacturing due to the inert environment in which it must operate.

**The environment**

Direct exposure to the laser beam must be avoided.

## Links

MaterialUniverse

Reference