Description

Image

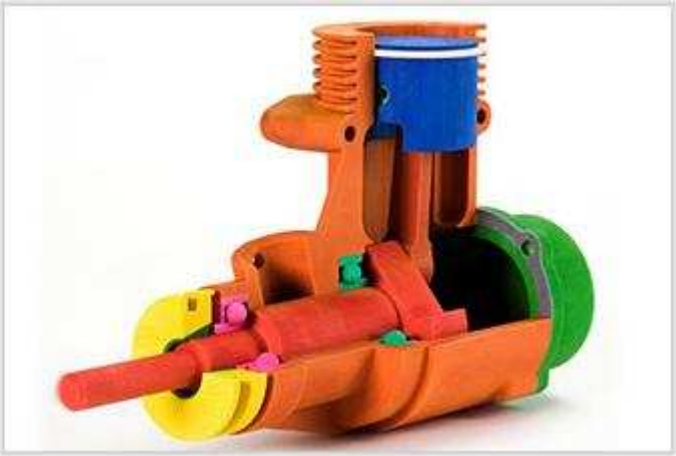


Image caption

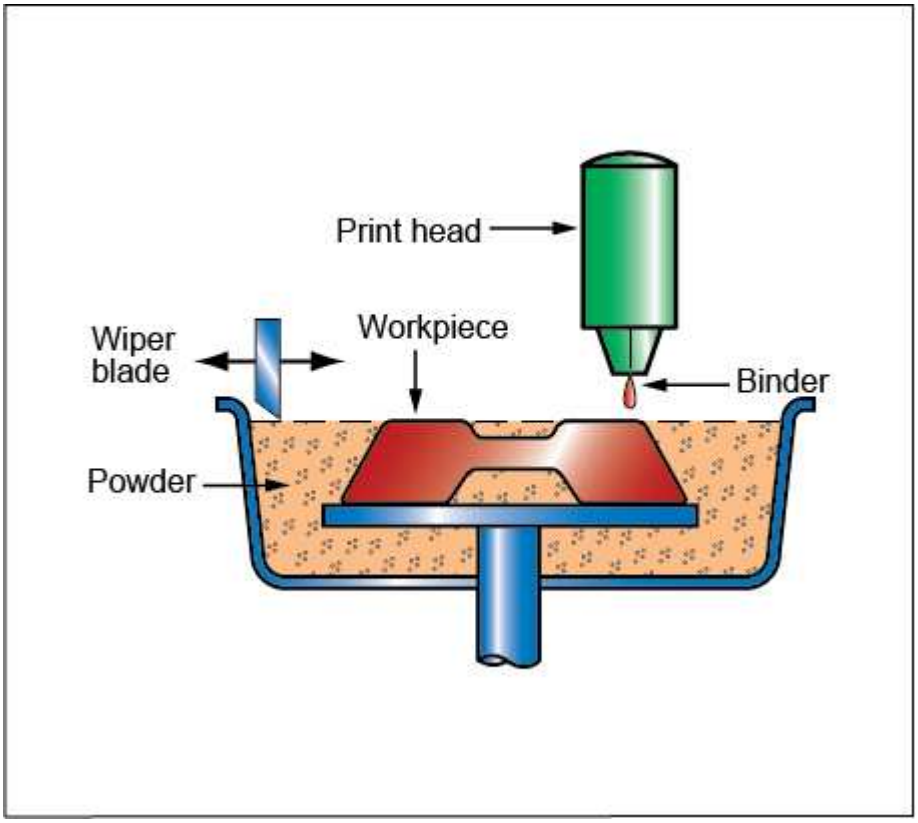
(1) 3D CAD model of cope or top half of mold. Model is exported as STL file ready for 3D printing in sand. © OKFoundryCompany at Wikimedia Commons (CC BY 2.0) (2) Full color print binder jetting © Print Botz

The process

In BINDER PRINTING, a multi-jet print head, like that of a bubble-jet printer, deposits droplets (80 microns in diameter) of binder onto a powder bed. After each sweep of the print head a new, thin layer of powder is spread across the surface of the model, so that on the next sweep of the print head a new layer of bonded powder is created. The final model is then shaken and blasted with pressurized air to remove excess powder. When used to make green compacts from ceramics the polymer must be burnt off before sintering. A wide variety of powder and binder combinations are possible. As with other additive manufacturing processes, a CAD solid model of the part is required.

Process schematic

No warranty is given for the accuracy of this data



Tradenames

3DP

Material compatibility

Ceramics	✓
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	-	100	

Physical and quality attributes

Mass range	0.1	-	50	kg

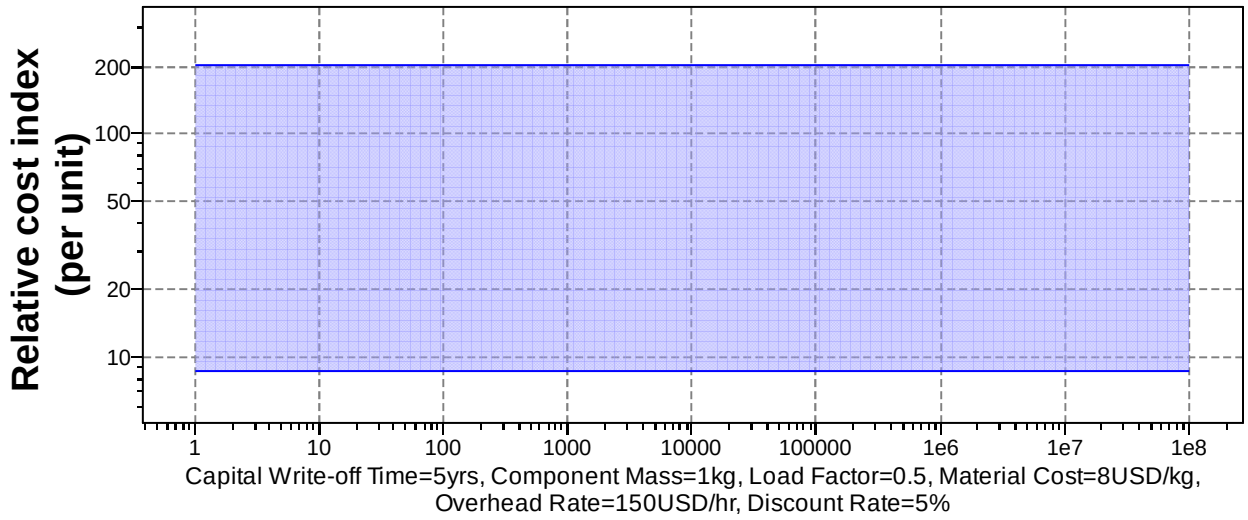
Process characteristics

Primary shaping processes	✓
Discrete	✓
Prototyping	✓

Cost model and defaults

Relative cost index (per unit)	8.6	-	201

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	1e5	-	1.5e6	USD
Material utilization fraction	0.95	-	1	
Production rate (units)	1	-	500	/hr
Tooling cost	0	-	0.1	USD
Tool life (units)	1e5	-	1e6	

Supporting information

Design guidelines

The accuracy and surface finish achieved are poorer than 3D printing, but it does not require separate support structures for overhangs. The resulting object is porous; however by infusing additional materials post-processing the mechanical properties may be improved.

Technical notes

The build envelope (L x W x H) ranges from 40 x 60 x 35 mm to 1800 x 1000 x 700 mm.
Typical layer thickness is 50 - 500 µm.
The production rate is very variable depending on the machine and complexity of the object, ranging from 8 - 85000 cubic cm per hour.

It is able to be much faster than 3D printing because only a comparatively small volume of the object is dispensed through the printer heads. Fully colored parts may be produced by using colored binder.

Typical uses

Concept models, prototypes of metal parts, low volume manufacturing, tooling. Molds and cores for sand casting (ceramic and metal).

The economics

After the capital cost of the machine, it costs around $0.75 per cubic cm to produce colored objects from sand and $2 from polymers.

The environment

Excess powder can be reused.

Links

MaterialUniverse

Reference