Description

Image

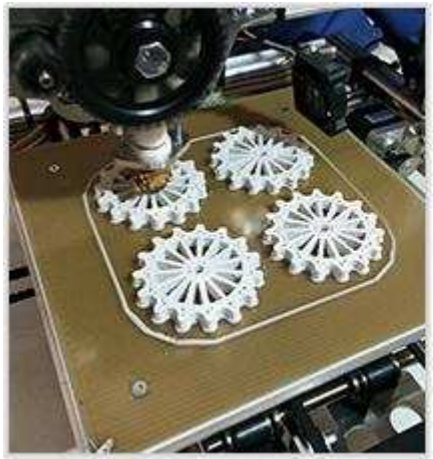


Image caption

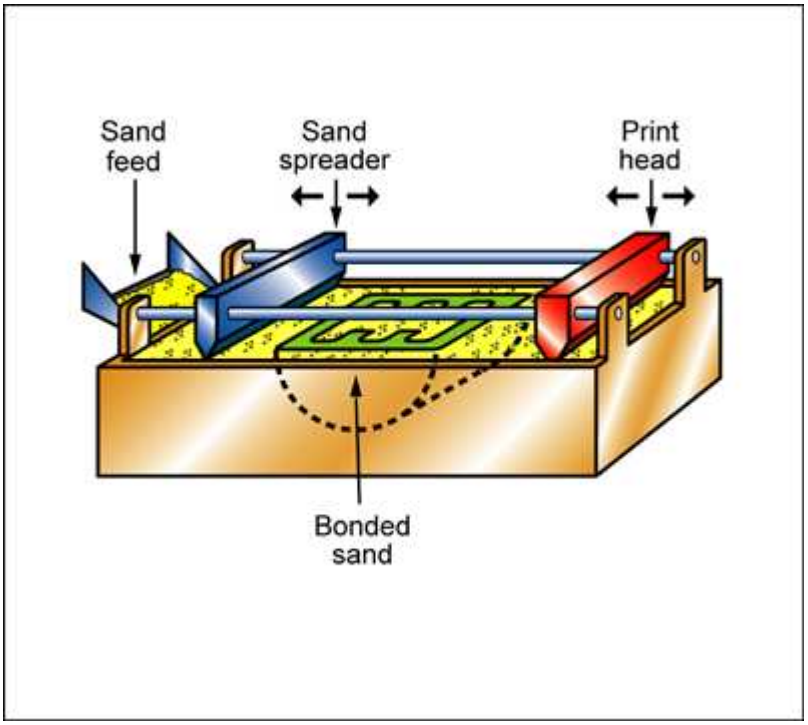
(1) Printing Robot Continuous tracks © CuriosityII at Wikimedia Commons (CC BY 4.0) (2) Ceramic mold made by 3D Printing and an orthopedic knee casting poured into a similar mold. © National Science Fundation (3) Ceramic 3D Printing by Studio Under © Studio Under at Wikimedia Commons (CC BY 3.0)

The process

In 3D CERAMIC MOLD PRINTING, a multi-jet print head, like that of a bubble-jet printer, deposits a binder on a bed of fine foundry sand. After each sweep of the print head, a new, thin, layer of sand is spread across the surface of the model, so that on the next sweep of the print head a new layer of bonded sand is created. The final model, after shaking it free of unbonded sand, now becomes the mold for a shell casting, allowing single metal parts with very complex shapes to be fabricated. As with other additive manufacturing processes, a CAD solid model of the part is required.

The data below refer to the casting itself, not the mold.

Process schematic



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	-	66.1	lb
Range of section thickness	31.5	-	3.94e3	mil
Tolerance	3.94	-	19.7	mil
Roughness	0.394	-	1.97	mil

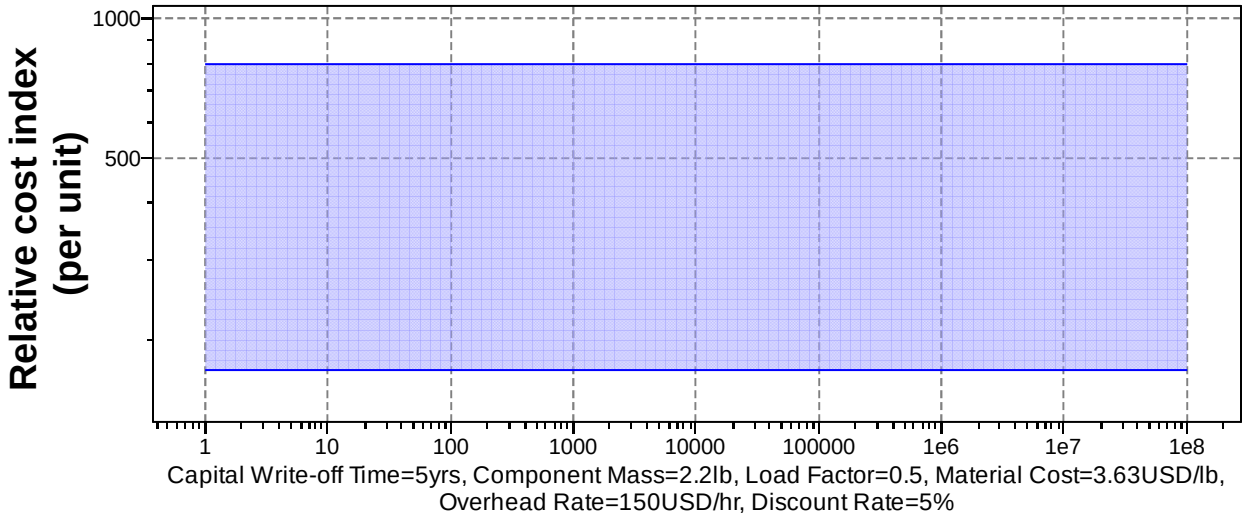
Process characteristics

Primary shaping processes	✓
Discrete	✓
Prototyping	✓

Cost model and defaults

Relative cost index (per unit)	172	-	794	

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	5.66e4	-	1.32e5	USD
Material utilization fraction	0.4	-	0.6	
Production rate (units)	0.2	-	1	/hr
Tooling cost	0	-	0.1	USD
Tool life (units)	1e5	-	1e6	

Supporting information

Design guidelines

3D printing expands the techniques for rapid prototyping with metals. Printing with wax gives patterns for lost wax casting, and sand-mold printing creates a mold for shell castings. Both techniques are capable of almost unlimited freedom of shape and of complexity.

Technical notes

Rapid prototyping systems are evolving very rapidly, and are already an essential part of the model-building capability of designers. Their speed and precision will increase and their cost will decrease in the future.

Typical uses

Mold making for castings up to 30 kg in

The economics

The cost of making an object by 3-dimensional printing depends on size and process - $300 to $3000 gives an idea. This will decrease as faster systems become available.

The environment

No particular environmental

Links

MaterialUniverse

Reference