Chapter 20
Rapid-Prototyping Operations

Parts Made by Rapid-Prototyping

Characteristics of Additive Rapid-Prototyping Technologies

Mechanical Properties of Selected Materials for Rapid Prototyping

Computational Steps in Rapid Prototyping

Fused-Deposition-Modeling
Support Materials and Structures in Parts

Figure 20.4 (a) A part with a protruding section which requires support material. (b) Common support structures used in rapid-prototyping machines. Source: P. F. Jacobs, Rapid Prototyping & Manufacturing: Fundamentals of Stereolithography. Society of Manufacturing Engineers, 1992.

Stereolithography

Figure 20.5 Schematic illustration of the stereolithography process.

Selective-Laser-Sintering

Figure 20.7 Schematic illustration of the selective-laser-sintering process. Source: After C. Deckard and P. F. McClure.

Three-Dimensional-Printing

Figure 20.8 Schematic illustration of the three-dimensional-printing process. Source: After E. Sachs and M. Cima.

Three-Dimensional-Printing to Produce Metal Parts

Figure 20.9 Three-dimensional-printing using (a) part-build, (b) sinter, and (c) infiltration steps to produce metal parts. (d) An example of a bronze-infiltrated stainless-steel part produced through three-dimensional printing. Source: Courtesy of ProMetal.

Laminated-Object-Manufacturing

Figure 20.11 (a) Schematic illustration of the laminated-object-manufacturing process. (b) Crankshaft-part example made by LOM. Source: (a) Courtesy of Helis, Inc. (b) After L. Wood.
Investment Casting Using Rapid-Prototyped Wax Parts

1. Pattern creation
2. Parts assembly
3. Pattern removal
4. Fill metal with sand
5. Cool and cast
6. Flash

Figure 20.14 Manufacturing steps for investment casting that uses rapid-prototyped wax parts as blanks. This method uses a flask for the investment, but a shell method also can be used. Source: Courtesy of 3D Systems, Inc.

Rapid Tooling for a Rear-Wiper Motor Cover

Figure 20.15 Rapid tooling for a rear-wiper motor cover. Source: Courtesy of 3D Systems, Inc.