Materials Used in Additive Manufacturing Processes

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Types of Materials

- Starch based powders (proprietary/non proprietary
- Sand
- Wood
- Ceramics
- Carbon Fiber
- High-end Cement
- Plaster
- Paper
- Metal Powders; stainless steel, bronze, cobalt
- Polyamide-powder

Properties

- Powder
- Solid
- Liquid

Processes

- 3-D Printing
- FDM (Fused Deposition Modeling)
- SLS (Selective Laser Sintering)
- SLA (Stereolithography)
- DMLS (Direct Metal Laser Sintering)
- SLM (Selective Laser Melting)
- EBM (Electron Beam Melting)

Fused Deposition Modeling (FDM)

- Materials
  - Thermoplastics
  - Polycarbonates
  - ABS --- acrylonitrile butadiene styrene
  - Polyetherimide
  - Polyphenylsulfone

Selective Layer Sintering (SLS)

- Materials
  - Photo-polymer powder

Stereolithography (SLA)

- Materials
  - Photo-polymer liquid

Direct Metal Laser Sintering (DMLS)
Selective Laser Melting (SLM)
Electron Beam Melting (EBM)

- Materials
  - Stainless Steel
  - Bronze
  - Titanium
  - Aluminum
  - Vanadium
  - Various Alloys

Uses

- Prototyping
- Modeling
- Production Parts

Materials/Processes Template

Material *(Type)*	**Properties** *(Powder, Solid, Liquid)*	**Process (es)** *(3-D Printing, FDM, SLS, SLA, DMLS, SLM, EBM)*	**Strength** *(Brittle, Strong)*	**Production Time (1 in^3)** *(Minimal=1-4 hrs, Moderate=3-5 hrs Lengthy = > 5hrs*	**Uses** *(Prototyping, Production Part, Modeling)*	**Post Processing Requirements** *(Sanding, Hardening, Painting,)*	**Cost** *(Inexpensive Expensive)*	
Starch	Powder	3-D Printing	Brittle	Minimal	Prototyping	Addition of hardener (Super Glue, Wax, etc..)	Inexpensive	
Stainless Steel	Powder	3-D Printing,	Brittle	Minimal	Prototyping, modeling,	Infused with additional metals	Expensive	
Stainless Steel	Powder	DMLS, SLM, EBM,	Strong	Minimal	Prototyping, modeling, Production parts	Sanding	Expensive	
ABS (Acrylonitrile Butadiene Styrene)	Solid	FDM	Relatively Strong	Moderate	Prototyping, Modeling, Production parts	Light Sanding, Support Removal, Painting	Inexpensive	
Photo-polymer	Powder, Liquid	SLS	Strong	Lengthy	Prototyping, Modeling, Production parts	Light Sanding, Painting,	Expensive	
Aluminum	Powder	DMLS, SLM, EBM	Strong	Lengthy	Prototyping, Modeling, Production Parts	Sanding	Expensive	
Nylon	Solid	FDM	Relatively Strong	Moderate	Prototyping, Modeling, Production Parts	Sanding	Inexpensive	
Plastic Ceramics	Solid	FDM	Relatively Strong	Moderate	Prototyping, Modeling, Production Parts	Sanding	Expensive	
Titanium	Powder	DMLS, SLM, EBM	Strong	Lengthy	Prototyping, Modeling, Production Parts	Sanding	Expensive	

Questions???

