

# 3D Printing/ Additive Manufacturing

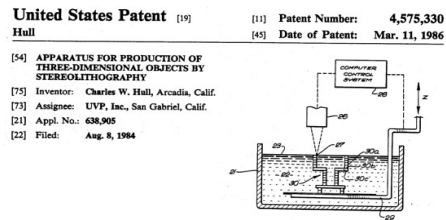
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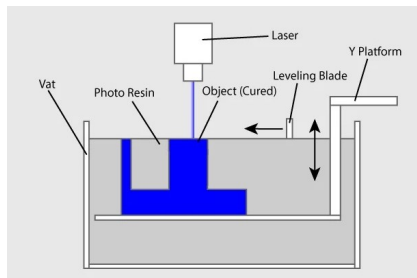
**3D Printing** or **Additive manufacturing (AM)** is a process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies. **ASTM F2792 - Standard Terminology for Additive Manufacturing Technologies.**

**Used terms:** Rapid Prototyping (& Manufacturing), Automated Fabrication (Auto-fab), (Solid) Free Form Fabrication, Layer-based Manufacturing, Rapid Manufacturing, Additive Manufacturing

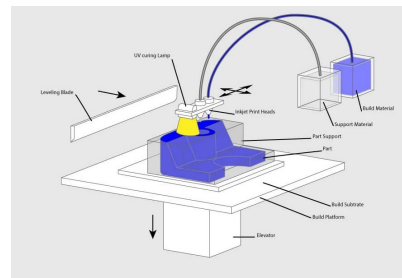
In 1984, Charles W. Hull created the first 3D printer (Patent: 1986). Hull defined stereolithography (3D printing method) as a method for making solid objects by successively printing thin layers of the ultraviolet curable material one on top of the other.



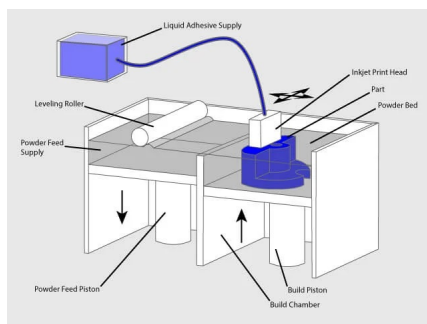
## The 7 AM/3D Printing methods (ASTM F42)



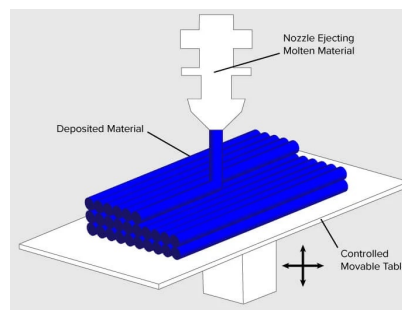
**(1) Vat Photopolymerization:** material is cured by light-activated polymerization.



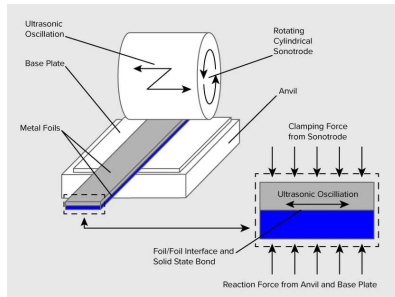
**(2) Material Jetting:** droplets of build material are jetted to form an object.



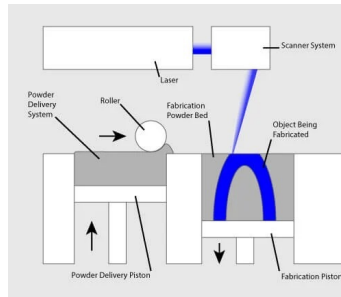
**(3) Binder Jetting:** liquid bonding agent is jetted to join powder materials.



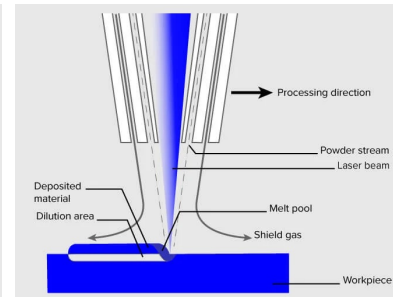
**(4) Material Extrusion:** material is selectively dispensed through a nozzle and solidifies.



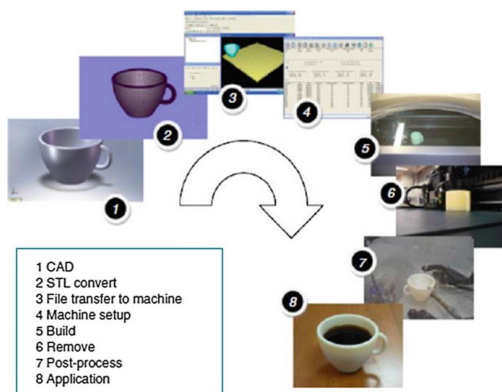
**(5) Sheet Lamination:** Sheets are bonded to form an object.



**(6) Powder bed fusion:** Energy (typically a laser or electron beam) is used to selectively fuse regions of a powder bed.



**(7) Directed Energy Deposition:** Focused thermal Energy is used to fuse materials by melting as deposition occurs.

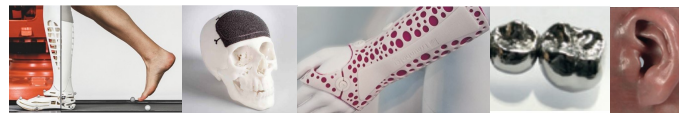


### The Generic AM Process

- Step 1:** CAD
- Step 2:** Conversion to STL
- Step 3:** Transfer to AM Machine and STL File Manipulation
- Step 4:** Machine Setup
- Step 5:** Build
- Step 6:** Removal
- Step 7:** Post-processing
- Step 8:** Application

3D Printing has gained acceptance in many fabrication areas including automotive, aerospace, engineering, medicine, biological systems, and food. **The advantages** of this technology over conventional manufacturing methods include **design freedom of forms** with **complex geometries**, product **customization**, and **material** and tool **saving**... AM has gained significant interest from both **academia** and **industrial** communities.

### Applications



[1] Ian Gibson, David Rosen, Brent Stucker, Additive Manufacturing Technologies 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, second edition, 2015. DOI 10.1007/978-1-4939-2113-3  
 [2] <https://3dprintingindustry.com/3d-printing-basics-free-beginners-guide>  
 [3] <https://3dprinting.com/what-is-3d-printing/>