

Introduction to Additive Manufacturing (AM)

AMS
Additive Manufacturing
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Within additive manufacturing (AM), there are seven main varieties of manufacturing styles. These types of AM can be seen on the website and is downloadable as a PDF.

AM had been thought of as a concept since the mid-20th century, specifically from sci-fi writer Murray Leinster in 1945. After this, it wasn't until 1971 when Johannes F. Gottwald filed a patent for a "Liquid metal recorder" that AM was nothing more than a pipe dream. This "liquid metal recorder" used liquid inks that had been electrically charged to be forced through a nozzle using magnetic forces. Unfortunately, the patent ended without any valuable results.

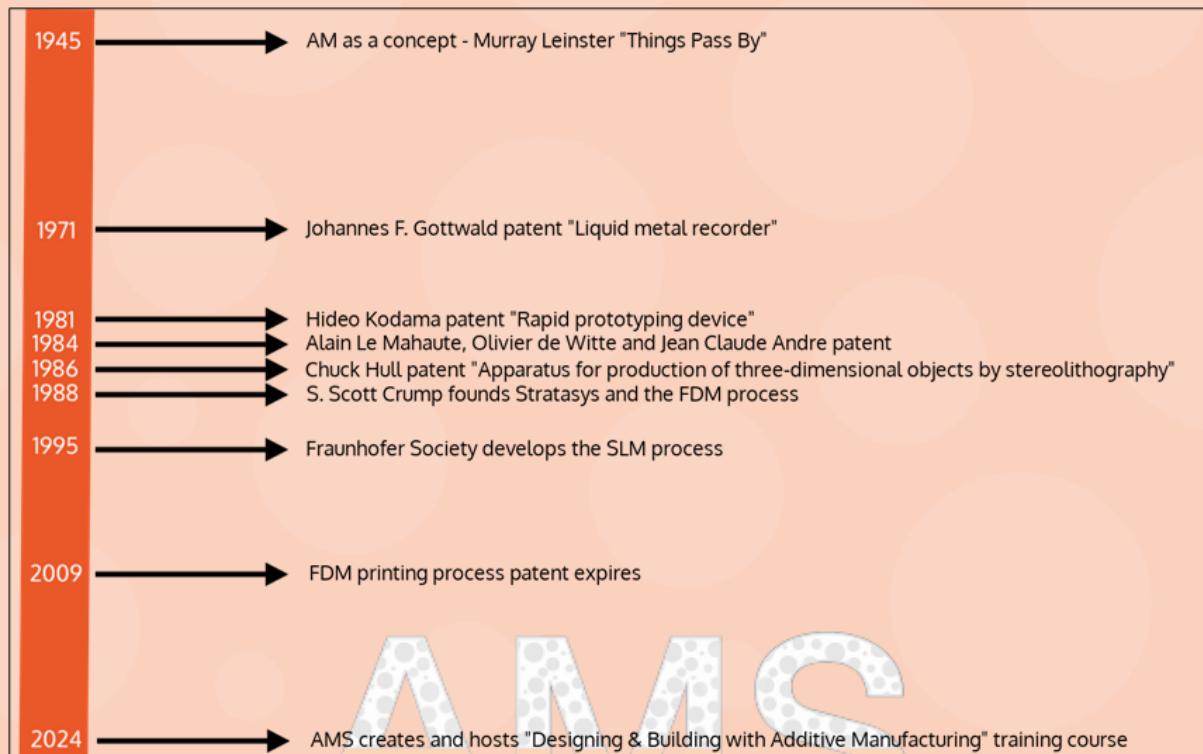
The next implementation came about in 1981 with Japanese inventor Hideo Kodama, which was the foundations for current stereolithography (SL/SLA) style printing. This involved a vat of photosensitive liquid polymer which is solidified by ultraviolet rays. Interestingly, the description of the product was a "rapid prototyping device" which to many of us is a good description for the AM industry. The patent for this didn't go through due to financial reasons.

The next breakthrough was from three French inventors in 1984 with a similar method to Hideo. Unfortunately, due to some technical issues with the patenting office, the patent was delayed from being pushed through, so Alain Le Méhauté, Olivier de Witte and Jean Claude André all missed out on the ownership of the title the fathers of 3D printing which is credited to Chuck Hull. Chuck patented the SLA technology process three weeks after the three forementioned scientists but got it approved sooner due to the three French inventors parent company, Alcatel, dismissing the patent before it went through processing due to a "lack of business perspective".

Chuck Hull got his patent in 1986 when he started his own company, 3D Systems. Just two years later, 3D Systems had released their first commercially available AM machine, the SLA-1. Hull is also the creator of the STL file format, which is still used today. We will discuss this file in further depth later. Fused deposition modelling (FDM, or material extrusion, MX, or fused filament fabrication, FFF) was created by S. Scott Crump in 1988. Crump is a co-founder of Stratasys, along with his wife Lisa. This method is the most used for hobbyist printing.

Between 1993-2000, AM technologies matured and became much more suitable for industry use. Then in 1995, Munich based research organisation, The Fraunhofer Society, developed the selective laser melting process, which is the basis for powder bed fusion and electron beam techniques. See figure 1 for a small timeline of all this.

Here is a timeline of AM:



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