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Edison Explains

3D printing

3D printing has fallen from the spotlight somewhat, but that doesn't mean its revolutionary potential has faded.

What is the state of the 3D printing market?

Following a surge in public excitement in the early 2010s, the 3D printing market peaked in terms of consumer interest after a heavy price point and heavier machines dissuaded most buyers from the market.

That said, the use of 3D printing has continued to expand in its core manufacturing-related fields, driven by a drift from plastic to metal feedstock, faster printing speeds and maturing software/design platforms. In addition, with an increasingly advanced set of technologies to choose from, 3D printing is still on the minds of many manufacturers.

How do 3D printers work?

Most investors are familiar material extrusion 3D printing, where melted plastic is released from nozzles in layers that build up to create a 3D object.

The first material extrusion printers used Fused Deposition Modelling (FDM), developed and patented by Stratasys. Since then, the company's patent has lapsed, but its trademark on FDM led to the creation of Fused Filament Fabrication (FFF) as an alternative term for the same process.

However, FDM was not the first 3D printer technology. That honour goes to vat polymerisation, which was developed in the early 1980s. In vat polymerisation, a container of photosensitive resin is selectively hardened using light.

This can be done using UV lasers in stereolithography (SLA) or, more recently, a digital projector screen in direct light processing (DLP).

Moving closer to the present, material jetting (MJ) is a more recently developed, UV-based printing method. In MJ photosensitive material is extruded from print heads, in a similar way to an inkjet printer, but in layers that harden on contact with UV light.

MJ uses plastics and some rubber-like and fully transparent materials as its feedstock.

What about 3D printing in metal?

So far little has been said of technologies best suited for printing in metal rather than plastic polymers. It is here that powder bed fusion comes into its own.

Used for printing metal, plastics and other materials, the technology turns a bed of powdered material into a 3D object by selectively fusing sections through the application of heat. To achieve this in plastic, selective laser sintering (SLS) uses lasers to heat powder selectively and fuse it.

For metal, the same principle is used in direct metal laser sintering (DMLS), selective laser melting (SLM) and selective heat sintering (SHS), with some slight variations. A more significant deviation from SLS can be seen in electron beam melting (EBM), which uses a distinct method of heat generation.

EBM uses a tungsten filament that is heated to emit electrons, which are guided at speed with electromagnets to heat the powdered material. The powder must be conductive for the process to work, excluding the use of polymer or ceramic material.

Binder jetting, a more distinctive variation, uses a powder bed, but fuses material, including metals, sands and ceramics, with a binding agent rather than heat.

Edison Insight:

'3D printing has moved through the hype phase. It is now widely used in industry to create prototypes, customised parts and low-volume production runs.' Anne Margaret Crow, TMT analyst

How are 3D printers used today?

For most consumers, 3D printers are too expensive and bulky, and require an extensive amount of effort and expertise to use, relegating them to a niche product for dedicated customers.

This is not to say that an enthusiastic base of dedicated consumers doesn't exist, creating a small retail segment, but

rather that the majority of the market is still geared towards enterprise.

Nor is 3D printing currently advanced enough to compete with established manufacturing methods at a large scale. It is instead used to accelerate product development, create flexibility in manufacturing and produce customised products.

Most notably, the ability to fabricate and replicate prototypes with slight variations quickly and cheaply to both speed up development and reduce expense, is very popular. The technology is also being exploited more and more in specialist fields, which require small batches of complex and customised components, eg in aeronautical and medical equipment manufacturing.

With the creation of new printed circuit boards that use 3D printers to quickly build and prototype electronic components, using layers of copper, conductive metals or conductive inks printed onto circuit boards, the potential of 3D printing in these fields can only grow.

In printed circuit boards (PCBs) Nano Dimensions' DragonFly 2020 Pro is a major competitor, while PTL Electronics, Voltera and BotFactory are also active in the market.

Which companies are active in the market?

A number of large tech companies are moving forwards in 3D printing. HP recently opened a 3D printing and digital manufacturing centre in Barcelona, while Siemens partnered with Interspectral, a developer of 3D visualisation tools for additive manufacturing.

As for manufacturers, Stratasys, EOS, ExOne, RepRap and Ultimaker, alongside Nano Dimensions, are all active.

Stratasys recently delivered a number of parts to Marshall Aerospace and will announces its Q219 results at the end of July.

Meanwhile, ExOne has announced that it will collaborate with Sandvik Additive Manufacturing on an advanced binder jet process. It has also partnered with Siemens, which will provide software for ExOne's hardware. Meanwhile, Ultimaker recently moved its headquarters to Utrecht in the Netherlands and rebranded.

In addition, there are a number of software platform and service providers, including 3D Hubs, Autodesk, SparkMaker, Kraftwürx and Materialise.