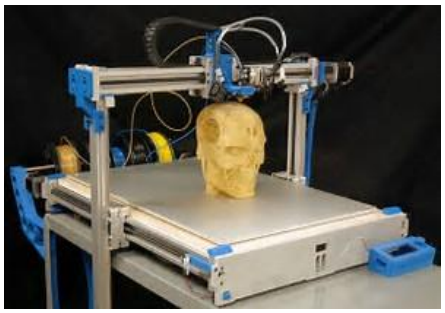
Technotes

The Skinny on 3D Printing



The Skinny on 3D Printing

Recently, within the past three years, I've had the opportunity to provide 3D models of aluminum extrusions designed by us for use in LED lighting and freight container systems. Both customers wanted to avoid tooling cost to validate fit and form off AutoCAD or Solid Works drawings. Can't much blame them, the hollow geometry of the profile, in both cases, were new product designs in excess of 7" circle sizes, which means expensive tooling. One product in particular, which I can't share due to non-disclosure agreements, had mating and hinging components making fit and form critical. The other profile was a single void hollow, but certain grooves and indentions designed for complimentary components also lent itself to closer scrutiny prior to product approval.

This gave me an idea – why don't we consider using 3D print technology in lieu of solid metal samples?

I sat down with Ken Brace, owner of Rapid Prototying Service in Satellite Beach, Florida. Ken provided me with the samples I referenced earlier, and has extensive experience and knowledge of the industry, processes, and future potential. What's unique about Ken is, he and his father owned a metals machine shop for twenty years, and after selling the business in 2001 he started his current venture. He spoke my language!

Beyond the periphery, I started my education into the potentials by asking, "Exactly what is the process?"

According to Ken, it all starts with making a virtual design of the object you want to create with Solid Works or AutoCAD programs using a 3D modeling application, or with a 3D scanner. After transferring the file to the printer, the creation of the object is achieved by using additive processes. In an additive process the object is created by laying down successive layers of material made of organic polymers such as polycarbonates, Nylon, ABS Plastics, or FDM thermoplastics. The raw material he showed me looked like heavy gauge fishing line. The technical name for this common process is FDM – Fused Deposition Modeling. The "fishing lines" are heated and build the object by "layering" each strand according to the geometry of the part, as seen in the illustration below.

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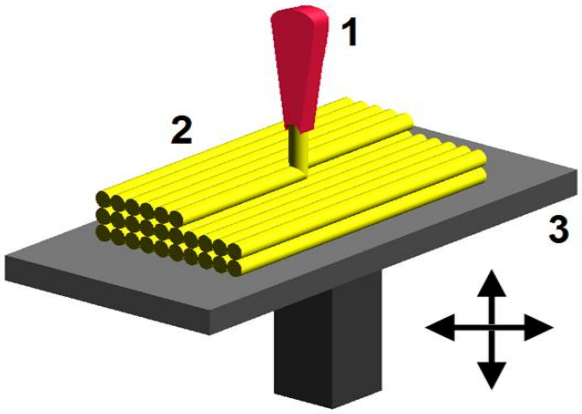
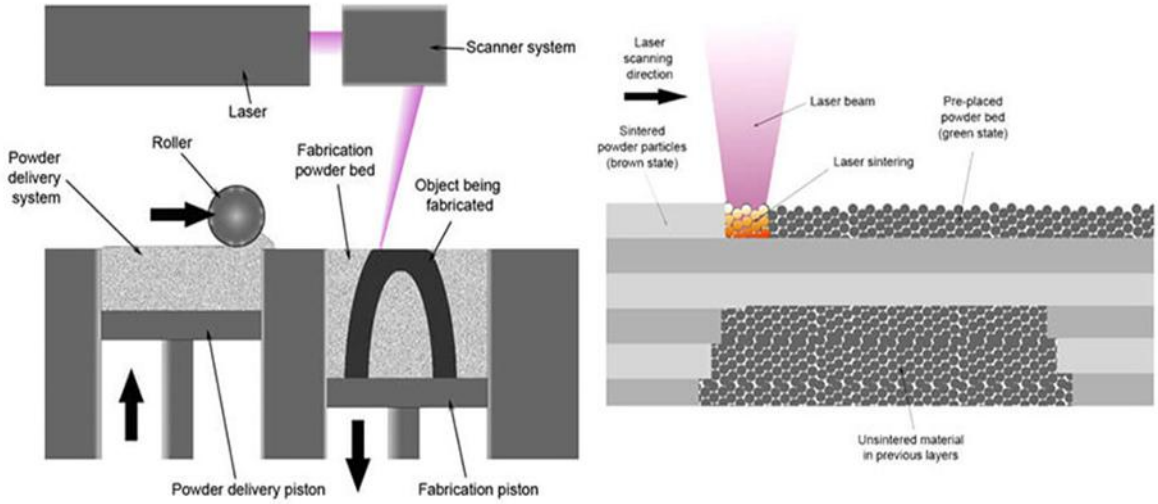


1 – Nozzle ejecting molten plastomer, 2 – deposited material (modelled part), 3 – controlled movable table.

Another common process, (SLS) Selective Laser Sintering, uses a high-power laser to fuse small particles of plastic, metal, ceramic, or glass powders into a mass that has the desired three-dimensional shape. The laser fuses the powdered material by scanning the cross-sections generated by the 3D modeling program on the surface of a powder bed. After each cross-section is scanned, the powder bed is lowered by one layer's thickness. Then a new layer of material is applied on top and the process is repeated until the object is completed, as illustrated below.



What are some of the current applications? Rapid prototyping parts for fit, form, and function in aerospace, prosthetics, reconstructing fossils in paleontology, replicating ancient artifacts in archaeology, reconstructing bones and body parts in forensic pathology, and reconstructing heavily damaged evidence acquired from crime scene investigations.

The automotive industry uses 3D printing for low volume prototyping applications, simple concept models for fit and finish checks and design verification, and functional parts used in test vehicles, engines, and platforms.

Architectural interests are prototyping for functional hinges, commercial hand rails, window & door components, and decorative trim have increased recently.

The intriguing part of the conversation with Ken surrounded the idea that 3D printing could include the ability to paint the object with a similar color to the specification in visual mock-ups for the architect or product engineer.

In addition to manufacturing uses, Bio Printing, the term for tissue engineering applications where organs and body parts are built of living cells deposited onto a gel medium and slowly built up to form three dimensional structures, is gaining momentum.

With this in mind, according to *Wohlers Report 2015*, the worldwide 3D printing market in 2013 was $3 Billion, and estimated to grow to $21 billion in 2020. That's pretty impressive considering the current technological constraints to mass production.

My take after two hours with Ken? Printing in 3D certainly has its niche in prototyping and small run parts. The reduced cost alone, versus tooling and machining samples, begs consideration as part of the differential decision process when product development enters the arena. Historically, we've had pretty good success with drawings produced by competent engineers. For those rare occasions where fit and form are beyond critical in product development it may be prudent to start with 3D.

Manufacturing on a mass production scale will, for now, be best left to our current extruding, casting, injection molding, roll forming, bending, etc. Comparatively speaking, these processes are capable, mature, and efficient with proven economies.

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