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Prototyping Power

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Material advancements and lowering price points fuel the additive fabrication fire as 3-D printing increases its presence in the marketplace.

"There is still a lot of work that needs to be done in the area of materials," says Terry Wohlers, principal consultant and president of Fort Collins, CO-based Wohlers Associates. According to Wohlers, if you compare the materials currently used in additive fabrication (rapid prototyping, 3-D printing) to the wide range of thermoplastics that are available, it's the same as comparing plastics to metals in the 1960s.

Back then, everything that was supposed to be durable was made out of metal, if it was made of plastic it was considered substandard. Plastic durability and dependency has come a long way over the years as the result of ongoing research and development. Similar to the development of its predecessor, the materials used for additive fabrication will continue to make exponential progress as developers apply the lessons learned as we evolved from metal- to plastic-dependency.

"We've seen steady growth [in material development]," says Wohlers. "We'd like to see more, but I don't think it's going to take 45 to 50 years to get where we're at with thermoplastics. We have set that experience with plastics so we can apply that knowledge and experience to these processes."

While tensile strength of ABS, ABS blends, polycarbonate, polyethersulphone, et cetera continues to increase, the industry is still looking for improvement. "I talk with customers and they still have a strong appetite for better materials, especially in the area of manufacturing," says Wohlers. "There are a lot of materials that are good enough for models and prototype parts, but not if you want something that is going to be on a vehicle (ground or air) where a break can be catastrophic."

Currently, many parts created using additive fabrication are being used as non-structural parts on planes. Hundreds of parts are also being used on military aircraft. "We're beginning to see them being used in areas that were once unthinkable," adds Wohlers.

Ongoing development has lead to strides in ABS, polycarbonate, PCABS and a wide range of Nylons (Nylon 11 and 12), as well as some filled nylons for laser sintering, among other materials. Titanium and cobalt-chrome are two metal powders that have seen dramatic improvements as a result of industry demand.

"Titanium and cobalt-chrome are getting a lot of attention both on the research and development side as well as on the buying side," Wohlers says. "People are buying the cobalt-

chrome for medical applications and the strength to weight ratio for parts has titanium growing in popularity." Titanium is used in the dental industry, as is cobalt-chrome which has seen a dramatic amount of work and interest from companies that are now building copings — the main structure of a crown or bridge.

Widening Breadth Of Application

Additive fabrication machines have continued to lower in price, the materials have improved, as have the accuracy and the speed, and improvements have been made to produce good quality models and prototype parts.

"It seems like more businesses are turning to prototyping early in their design process," says Scott McGowan, marketing director for Valencia, CA-based Solid Concepts. "Businesses are recognizing the cost savings when you prototype early, because you discover either design errors or simple changes that you want to make in your design early in the process."

Companies continue to use the machines to create custom and replacement parts, short run production parts as well as during break runs. While they're waiting for production tooling they are using laser sintering to develop hundreds of parts until they receive the requisite production tools.

"Automotive and aerospace were the pioneers as far as the use of the technology, then came consumer products, sporting goods, the entertainment (gaming) industry," says Wohlers. "The medical industry is also beginning to embrace it in a big way where they're producing not from CAD data, but medical scan data from MRI and CT scanners to produce custom parts." The parts are developed mostly to help teams of doctors as they prepare for maxillofacial and craniofacial reconstructive surgeries. Dentistry and the jewelry industries have taken off as well.

"It seems like more people are understanding prototyping and how it fits into their development process," adds McGowan. "It is excellent not only for design verification, fit verification, but also for concept verification, to show people what it is that they're working on and get back feedback early and often as the project progresses."