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SPECIAL FEATURE

Additive manufacturing: A user's guide

Liz Nickels

Sometimes it's hard to keep track of the burgeoning additive manufacturing industry. What's the difference between EBM and EBAM? Is SLS the same as DMLS? Luckily help is at hand. Liz Nickels spoke to Louis Davis of Stone Interactive Group, who has created a diagram to help users make sense of it all.

The growth of metal additive manufacturing (AM) has been so rapid and all-encompassing that sometimes it is hard to keep track of the different processes and companies. Louis Davis, a self-professed newcomer to the industry, has put together a diagram of metal 3D printing processes and the major companies involved to help other newbies learn more about the breadth and depth of technology already available.

'In my experience, this is one of the most rapidly evolving industries in the world right now,' he says. 'There is real innovation happening, both in the consumer-geared desktop 3D printing space and especially with industrial additive manufacturing. It's the latter that I'm more familiar with and what I've been consulting on for the past couple of years.'

What has prompted such rapid growth? 'There's a huge potential for cost savings. Fortune 500 corporations and other aerospace, defense, and metals companies wouldn't be investing to the hilt if they didn't see obvious potential from a cost savings and performance standpoint.'

According to Louis, metal is big business. 'It's exploding… 3D printing with sand, plastic and other particles has definitely found viability in the industrial sector. But in terms of real, functional parts, metal generally presents a much more compelling long-term business case than you're going to find using a plastic prototype printer,' Louis argues. 'GE's LEAP engine is just the start. I'm excited to see where it's going, and what's possible in terms of applications for metal parts.'

Acronym confusion

Why create this diagram? 'I'm not a technologist, I'm just a researcher. What I found when researching the industry is that there are a countless number of acronyms used by companies to market their 3D printing process. Sometimes it's unclear if they are referring to their own proprietary technology, or if it's just the general scientific method used,' he explains. 'For example, under the banner of selective laser sintering, there are probably over 10 different acronyms to describe essentially the same process. Similarly, although electron beam additive manufacturing (EBAM) and electron beam melting (EBM) sound nearly identical and share a common power source, beyond that they're completely different – one uses wire feedstock and the other uses powder.'

'Because the industry is growing so quickly there's so much information that's hard to pin down. Just from looking at one of these diagrams you can see 20–30 companies that are significant players in this industry, and they all have their own process name,' he says. 'While doing the research I realized that there is not much out there covering the metal AM industry as a whole. So the goal was to create an initial diagram for anyone who's trying to understand how the different metal 3D printing process relate to one another, so that they can then go on to research individual companies.'

Louis credits the Senvol Database (senvol.com/database) for his information. 'All the credit goes to Senvol. They've become a popular resource in the past year or so, and is the primary source for this diagram. Credit to them too for realizing there needed to be some kind of search engine or directory specifically for industrial 3D printing.'

The diagram also shows how international the industry is. 'Yes, they come from all over the place, from Chicago to Sweden, Germany, Israel, and China.'

Out of all of the processes, which does Louis think has the most potential? 'It depends on the application. Speaking as a layman, I believe the three biggest factors to use when assessing a technology

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are size, speed, and part quality/consistency. Any process which focuses on these points is going to have a lot of potential, but the ultimate goal is to make a part that is fully functional as an actual production component; not just a prototype.'

'But, again, the 'best' process varies so much by application. If you only need a part that can sit in your palm of your hand, you will probably use selective laser sintering. However, if you want to create a huge metal part, electronic beam additive manufacturing might be a better choice.'

How will the industry have changed in 20 years' time? 'I'm no Terry Wohlers, but I think it could go either way,' Louis suggests. 'You could see it continue to grow exponentially with more and more processes and companies. On the other hand, we could see a shift toward consolidation with bigger companies buying up smaller ones up. We've already seem a bit of that recently. But without a doubt, 20 years from now, more and more essential parts of automobiles, civil airplanes, and other military aircraft and equipment will be 3D printed, that's beyond dispute. I'm not sure how we'll get there but we definitely will.'

Stone Interactive Group; www.stoneig.com

EOS' M 290 metal 3D printer, one of the German-based company's flagship machines.

A titanium manifold built using UK-based Renishaw's metal powder bed fusion additive manufacturing system.

Companies in depth

The US contingent

3D systems

3D system, headquartered in Rock Hill, South Carolina, USA, provides a range of 3D digital design and fabrication solutions available today, including 3D printers, print materials and cloud-sourced custom parts. According to the company, 3D Systems invented 3D printing with its stereolithography printer and was the first to commercialize it in 1989. 3D Systems also claims to have invented selective laser sintering printing. It was the first to commercialize it in 1992. Today its range of 3D printers can make production-grade parts for in aerospace, automotive, patient specific medical device and a variety of consumer, electronic and fashion accessories.
www.3Dsystems.com

DM3D

DM3D, based in Auburn Hills, MI, USA, uses laser based direct metal deposition technology to form functional metal parts directly from a 3D CAD data. According to the company, over 20 years ago, Dr. Jyoti Mazumder created and developed DMD Technology which makes 3D components from powdered metals and lasers directly from computer-aided design (CAD) data with the help of its proprietary close loop control technology. Unlike laser sintering, traditional coating or thermal spray processes, DMD Technology produces fully dense metal parts with a strong metallurgical bond to the base material, resulting in production parts, the company says. DMD technology is suitable for hardfacing wear surfaces, remanufacturing components, restoration of high value parts and fabricating value added parts using complex metal powder recipes such as bimets, cermets and superalloys.
www.pomgroup.com

ExOne

ExOne, headquartered in North Huntingdon, PA, USA, a publicly traded manufacturing technology company, provides 3D printing machines, 3D printed products and related services to industrial customers in multiple segments, including pumps, automotive, aerospace, heavy equipment and energy. The ExOne process uses binder jetting technology with industrial materials. It uses traditional industrial strength materials ranging from metals to silica sand and ceramics to make designs, prototypes, and production parts.
www.exone.com

Fabrisonic

Fabrisonic LLC provides 3D metal printing services in a wide range of metals through its patented ultrasonic additive manufacturing process. It was formed in 2011 to consolidate the intellectual property of EWI, an Ohio base research organization, and a Michigan based for-profit. Fabrisonic controls nine patents covering all aspects of ultrasonic additive manufacturing. The