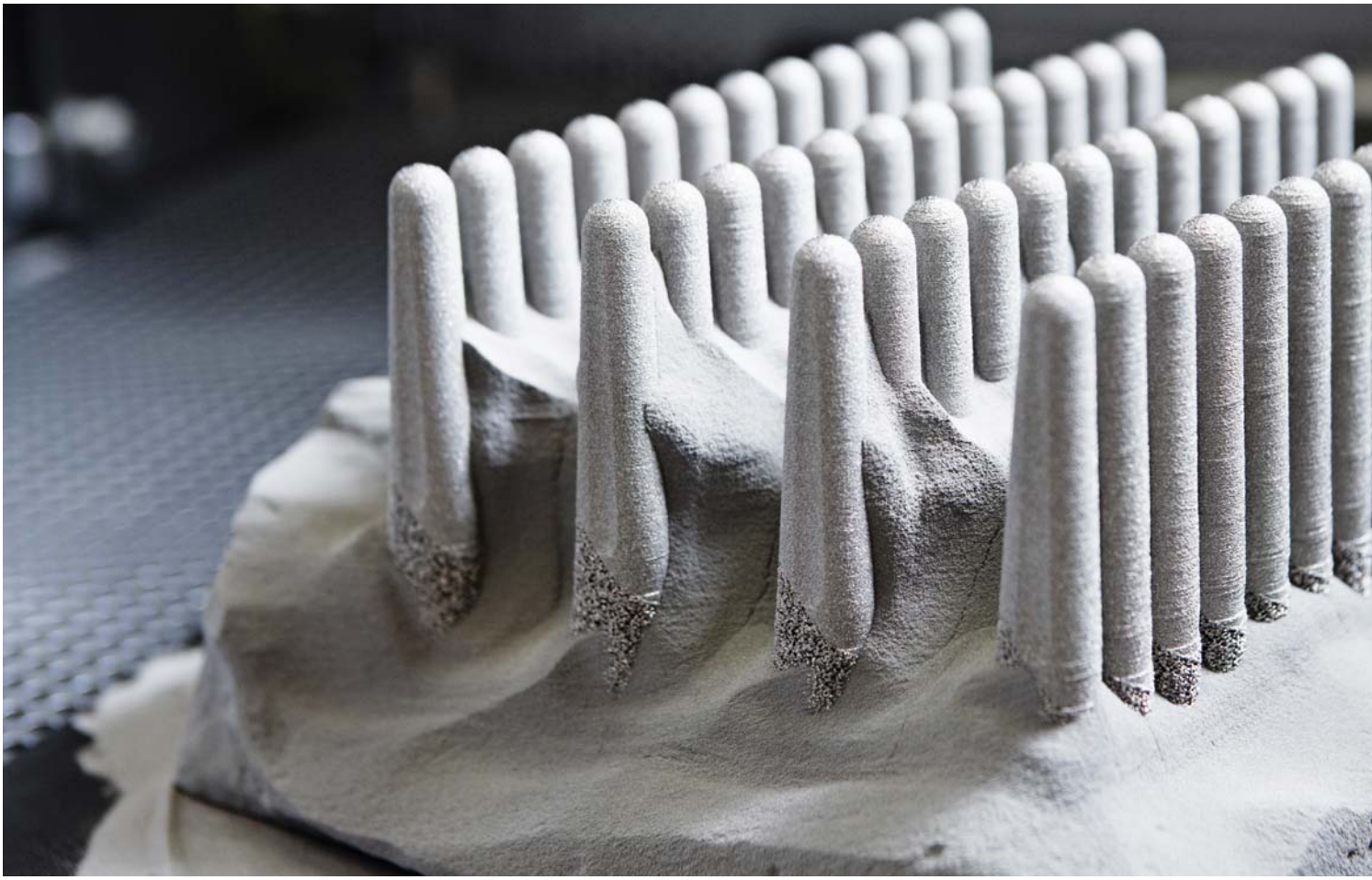

Arcam creates value through Additive M

Additive Manufacturing is steadily gaining acceptance for production of critical components in various industries. With their EBM (Electron Beam Melting) process and powder manufacturing, Arcam is in the forefront of this development, with an increasing number of production applications primarily within the aerospace and orthopaedic implant industries. 3D fab+print spoke with Bruce Bradshaw, Chief Marketing Officer with Arcam, to find out all about the impact of Additive Manufacturing, the Arcam Group, and why customer stories are the best.

By Jolanda Heunen

Mr. Bradshaw has been with Arcam for about a year and a half and has been active in the AM industry much longer having served as VP of Marketing for Stratasys for 8 years prior to Arcam. He knows the 3D printing market well and after working in marketing pretty much his whole life, he is now CMO with Arcam. The real manufacturing and production side of additive manufacturing is what drew him to Arcam. He runs marketing across the entire Arcam group, so not only Arcam EBM systems but also their other two companies: powder manufacturer AP&C and DTI, Arcam's contract manufacturer for orthopaedics.

Metal Additive Manufacturing with Arcam

Arcam is active in the metal additive manufacturing space. The technology probably closest related to their EBM technology is DMLS, commonly referred to as laser technology. "They're both powder bed fusion technologies but where Arcam differs is the energy source. Arcam EBM uses a 3,000 Watt gun where it's common for a DMLS machine to use a 100 or 200 Watt laser for the energy source," Mr. Bradshaw tells. "The result is five to ten times faster in terms of melting and speed than lasers which results in much higher productivity for production environments. Plus EBM parts are built in a vacuum chamber where we heat the powder bed before we actually start to melt."

In laser technology a laser is used on cold powder which means that as you

Hip stems in a powder cake after EBM build

anufacturing

start building layer by layer, powder melts quickly underneath it, which means residual stresses or warping may occur. "With EBM you're less likely to have that because you're bonding layers together at similar temperatures. And what this really means is: we have the ability to build larger, bulkier parts than laser."

What also differentiates Arcam's technology is the ability – because of the hot process – to actually nest and stack in the z-axis. "Take for example hip cups for orthopedic implants. We are able to produce 80 hip cups in a single build because not every part has to have support attached to the build plate. In laser every part you're building requires support starting at the build plate due to its process. So productivity-wise, an EBM system will build 80 compared to 12 hip cups in a similar sized laser machine."

The Arcam Group

Arcam is all about production with metal AM. "People aren't typically using our machines to do prototyping, they do when they are going through the qualification or certification process of a given product but their final goal is not to use our machines for simple prototyping. They choose EBM because their end goal is true production and EBM delivers the production capabilities required for manufacturing."

Arcam is known for its systems but the Arcam Group is a much broader organisation. "We have two other companies: AP&C, they are a powder manufacturer in Montréal Canada and they're the largest AM powder manufacturer for titanium in the world," Mr. Bradshaw states. "And then we have DTI which is the centre of excellence for orthopaedics for additive manufacturing in Connecticut. These two organisations that are part of the Arcam Group separate us from the rest of the players. Nobody else in the industry has a full suite of solutions like we do. We're a powder manufacturer as well as a contract manufacturer for orthopaedics, and a machine supplier."

Orthopaedic implant

the possibility of delaminating from the original part and, well, ten years out if it starts to delaminate, there's patient concerns." Mr. Bradshaw sees one important difference between aerospace and orthopaedics: "They are approaching this at two different paces. Where for most of the aerospace companies, the long-term goal is to create new parts from the ground up and design new parts from scratch. Their short term goal is they're taking existing parts and redesign them for additive. In the orthopaedic space, they are doing the exact opposite, they're designing products right from scratch with additive." So in terms of using the advantage of additive, orthopaedic is seeing the benefits a bit faster.

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Aerospace and orthopaedics

"Metal AM is definitely a strategic initiative for both market places," Mr. Bradshaw starts when asked after the impact of the technique on aerospace and orthopaedics. "They're strategic because of product advantages. Light weight, lower cost, higher buy-to-fly ratios in the case of aerospace for example. And for orthopaedic companies, a big driver for them for example is to develop designs that promote faster bone ingrowth. The most progressive companies right now are designing their own net structure or trabecular structure that interfaces with the bone. With this they aim to achieve faster bone ingrowth, so a patient's recovery is quicker, as well as a tighter bond," Mr. Bradshaw explains. "Without AM, what orthopaedic companies have to do is spray-coat an orthopaedic that's done on a conventional machine, such as CNC. This holds

The Arcam Q20plus is specifically designed for cost-efficient production of aerospace components

Inside an open door of an Arcam Q20plus

Benefits of implementing (metal) AM

3D printing has been around for a long time already yet is still in its infancy for companies to really adopt the technology. Mr. Bradshaw sees this as partly due to the level of education and skill sets of companies. "A lot of companies are lagging behind, because their designers and manufacturing people didn't grow up with 3D printing. It isn't ingrained just yet. They have to relearn new manufacturing techniques while the younger generation take this as core competencies in school and come out of education with this as a skill set," Mr. Bradshaw tells. "Ten years ago there weren't AM courses at schools and now they've become important curriculum at engineering schools all over the world."

He sees change in companies though, because 3D printing is a hot topic and companies are diving into the technology more and more. Understanding the benefits of what AM can deliver is one important step on the way. As Mr. Bradshaw puts it: "In general, adopting AM is going to give companies so much more design flexibility. They can produce parts and components that they've never dreamed of, with different designs or composite materials, things that are just not available in conventional manufacturing methods. So the world is their oyster when it comes to AM; they can do so much more and create products that they didn't have the ability to do prior to AM."

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The application possibilities are endless for AM. Aerospace organizations are looking into the future for maintenance, repair and overhaul applications as an example. "If you are an aerospace company, right now for the old aircraft they have to keep inventory of brackets and parts all over and they have an inventory of parts that may never get used. But if they setup five AM depots around the US with additive manufacturing components or printers there, and a plane has an issue, then you can actually print that part without having the burden of carrying fifteen parts in inventory – somewhat just-in-time manufacture for these companies."

And for orthopaedics, Mr. Bradshaw underscores the capability of designing better products with important IP for the OEM, especially the ability to design better products that help patients with issues like bone ingrowth for faster recovery times and life improvement.

Challenges for metal AM

Arcam is an organisation that is looking to help companies get into production. "Getting to market means getting through the regulatory processes and I think this is sometimes underestimated," Mr. Bradshaw tells. "International standards and regulations are very important. We need these, especially if you talk about the FAA and the FDA, since this concerns products that go into bodies and flight-critical components on aircrafts." Organisations for this are just starting to turn the corner and they look at AM as a viable production solution. "They're moving rapidly in trying to establish standards. But it's still in its infancy for them, there's not a lot of use cases sometimes, for them to reference, which is why I think organisations like Arcam are important as we do have companies in production," Mr. Bradshaw states.

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And from a standards standpoint like material standards such as ASTM: "Those organisations definitely see additive as an advantage, but they're having to tweak their standards a little bit because there are pros and there are cons. You have the ability to print a blended material, titanium aluminide for instance, that you can't do conventionally. They ask themselves 'what does this mean from a standards standpoint?' and see they now have to think about it differently. So all of these regulatory organisations are starting to look at AM in a different way. The initial way, the way they looked at it before was: they would take an AM part and apply the conventional standards to it and it didn't always work, since it's a different process. They are now starting to understand that they have to treat it differently. It needs a whole new way of thinking and a whole new set of standards, because it's different and they recognize that AM offers advantages."

Arcam is part of the ASTM standards organisation and are helping their customers with this. "We refer to DTI based in Shelton, CT as the centre of excellence for orthopaedics, for AM. And we say this because companies that are looking to get into AM – and maybe they can't afford to buy a printer yet but they see the advantages for orthopaedics – they can go to DTI

Spinal implants

and DTI will help them, help them design their products. And then actually go through the 510(k) process with the FDA on how to get their product approved by the FDA for AM," Mr. Bradshaw explains. "There are a set of testing methods that are required for certification by the FDA. DTI has the experience with both conventional and AM because they've dealt with 5 or 10 other companies in this scenario before. They know where AM has failed a test in the past and can guide a company very early in the process to get them through FDA process much more efficiently."

And the same applies to the aerospace side where for example AP&C consults with the OEM manufacturers to help in getting products approved by the FAA by ensuring their powder spec is well tuned for the AM process. "Although we're not working directly with the FDA or the FAA, we understand their processes well and help customers get through those processes."

Markets and developments

Arcam is headquartered in Sweden and that's where the EBM manufacturing is done. They also have subsidiaries in the United States, as well as a subsidiary in the UK, in Italy, in Germany and in china. These Arcam offices sell and service systems in these countries. The rest of the world is covered through agents.

Europe has the largest installed base. "Metal AM has been adopted faster in Europe than in any other place," Mr. Bradshaw tells. "And China and the US are the two fastest growing markets for us."

Regarding projects and developments Mr. Bradshaw points out that there's a lot going on behind the curtain that he can't talk about. But he can tell they are building out DTI as the centre of excellence for orthopaedics. "That's a relatively new spin if you will, we've always had that expertise but we haven't really branded it that way so we're promoting DTI in order for companies to actually make it to market faster."

Stacked hip cups on a build plate

Turbine blade from different angles

And AP&C is building a second plant right now that is due to open up in September. "This will double the capacity of titanium powder of AP&C," Mr. Bradshaw explains. "And of course we recently introduced the Qplus series of EBM machines."

I ask Mr. Bradshaw what headlines he would like to read in the media about Arcam, and got an answer. "What I think is important is a headline that highlights an application story where a customer or a customers' customer recognize real benefit. It's less about Arcam being the headline. I want to read about xyz company that has brought a product to market that is changing their business environment because of EBM technology, because of AP&C powder, because of the knowledge we brought to them via DTI. To me that is a feel-good story about technology and the fact that we're helping companies to get to market faster and build better products and serve their customers better, that's the headline I'd like to see. It's about what our customers are doing, that is what's important to us."

"International standards and regulations are very important. We need these, especially if you talk about the FAA and the FDA, since this concerns products that go into bodies and flight-critical components on aircrafts."

Conclusion

So just-in-time manufacturing, lighter products, cost saving, being able to produce products faster, being able to produce components that couldn't be designed before, all of these things can be achieved by implementing AM and all this is made possible by Arcam. So

EBM in practice

Back in September 2016 GE announced that they were interested in purchasing Arcam. They are currently the largest shareholder for Arcam and negotiations are well underway. GE is creating a GE Additive division in which both laser technology and EBM technology will be part of GE. GE is also using EBM technology for production, through Avio Aero for example, a GE company in Italy that uses EBM to produce low-pressure turbine blades.

And there are many more companies worldwide that embrace the technique and have implemented this. Companies such as Rolls-Royce, Lima Corporate and GKN Aerospace are all using Arcam's EBM technology. These users show the technology works for producing actual end parts and products. On the Arcam website there is a video section where their stories are made visual: http://www.arcam.com/company/resources/videos. Arcam is telling these stories because for them it makes more sense for other companies to actually see what the technology is capable of in practice, rather than read about it in a brochure. In this way Arcam are educating the market by telling their customers' stories.