"Additive Manufacturing is Innovative by Nature"

3DCeram Sinto is a French-tech based in Limoges with 15 years of experience in 3D printing of complex ceramic parts with a broad spectrum of products and services and its own product line of 3D printers. Interceram spoke to Nicolas Rousselet, Aerospace Business Manager, and Kareen Malsallez, Marketing Manager, about a new service tailored to the needs of customers in the aerospace industry.

Interceram: What is the special strength of the printing technology of 3DCeram?

Nicolas Rousselet: At 3DCeram we developed stereolithography (SLA) for ceramics. SLA is very interesting because it is the most precise AM technology. For example, if we compare it to fused deposition modeling (FDM) or extrusion, SLA is superior in precision because we use a UV laser. The laser is the most precise tool for polymerization and shaping of the part. This makes our process appealing to companies because our printed parts have very good mechanical and thermal properties. Our technology is therefore suited for many different applications, for example in the aerospace industry.

And in addition to our large printer we have also developed a printer with a small platform, the C100. This version is suitable for companies that want flexibility in their development process. With a small printer, the development costs are reduced because of the smaller investment. So a development partner buys a small platform to develop the products and afterwards, when the number of parts is increased, it is possible to scale up the process to the printer with the large platform. So our printers provide a platform for parts of various types and sizes.

Kareen Malsallez: We also see a trend towards mass customization, which is now increasingly demanded by the industry. This is why we have developed a full scale printer, which can cover the entire production process from prototype development to mass customization. Moreover, our SLA technology also offers a lot of flexibility when developing and processing new applications.

What significance does additive manufacturing have as a production technology in the aerospace industry? Which of the process properties offer an advantage here?

Nicolas Rousselet: The aerospace industry is changing. New private companies are entering the market. This sector is called 'new space'. In this field of business, the new priority is to downsize and reduce the weight of parts, for example of satellites, and also to reduce the costs and the time to launching. Here, our SLA process and our ceramic materials open a way to design parts with a complex architecture and more functionalities. This is also important in terms of the strong competitiveness that exists in the new space sector.

The other factor is that additive manufacturing is a flexible manufacturing process. The process can be adapted to every step of a development phase because part modifications can be done without extra costs. With additive manufacturing you are able to print the design, to modify the design and then to print it again. This couldn't be done with manufacturing by extrusion or by injection moulding. Additive manufacturing is innovative by nature.

What are typical aerospace components that can be printed very well with your technology?

Nicolas Rousselet: Ceramic components are already used in the aerospace industry, for example in satellites. The material is interesting for this industry because of its excellent mechanical and thermal properties, and of course because of its low density. Ceramic is a lightweight material by nature. And with additive manufacturing we are able to optimize these ceramic parts, for example an antenna based on lattice structures or a lightweight mirror for an optical system.

The new space really is a competitive market, so additive manufacturing is the answer they are all looking for. The added value of additive manufacturing is not the ceramic material because ceramics are already in use in this industry. The value comes from the freedom of design and the new way of manufacturing because with additive manufacturing you have a significantly shorter production time. The companies are not looking for new ceramics; they are looking for the new way of producing the parts they need.

Recently, 3DCeram started offering a special service called 3D-AIM. What does it stand for?

Kareen Malsallez: We play with the word 'goal' like 'aiming at a goal'. But it also includes the abbreviation for aerospace industry. This service is completely new, and we are working on defining it. It is actually an answer to what our customers and stakeholders are looking for. So 3D-AIM was created as a result of market demand.

What does this service involve?

Nicolas Rousselet: 3D-AIM is a customized support for aerospace companies which consider additive manufacturing as a good solution for their future projects. We help the company to develop the ceramic application from scratch to the part production. We start with a discussion about their specifications such as technical specifications

like mechanical preferences but also economic specifications. This could be a targeted time frame or targeted cost plan.

This approach is flexible because we can adapt it to different project phases. We start from scratch, from the blank pages to the production of parts, or we can make modifications to existing ceramic parts. Overall, 3D-AIM is a global approach because we manage the design phases, the production phases and then the technology transfer to the customer.

Our approach at 3D-AIM consists of three steps. The first step is a feasibility analysis. As I mentioned before, we start with a discussion with our customer about their requirements. And we talk about all the aspects of this project from its current structures to the part production. It is very important to gather all this information at the beginning of the project, because we are about to modify the design and modify the process and all the aspects of the project according to these requirements. And afterwards we define a risk analysis and propose a de-risking plan. This is a series of development steps to mitigate the risk of this application in our process.

Kareen Malsallez: Most of the time the part already exists and the company produces it in traditional ways for example by machining. Then they hear about additive manufacturing and are maybe thinking about optimizing their part and adding a few new functions, and sometimes they also turn to additive manufacturing because it's a reliable process in terms of costs. A cost analysis is also part of our risk analysis and the de-risking plan.

© Rousselet

Nicolas Rousselet

Nicolas Rousselet received his Master's degree in engineering from ENIM in 2010 and his MBA from the Paris Panthéon-Sorbonne Business University in 2019. From 2011 to 2017, he worked in several aerospace companies as an opto-mechanical engineer. He joined 3DCeram as Business Unit Manager in 2018. Since September 2019 he is Aerospace Business Manager.

So at the beginning of a new project we want to answer the questions: How can a part be produced by additive manufacturing? Is it worth doing it in terms of costs? Can the part be optimized and can new functionalities be added?

Could you specify what the risk analysis entails?

Nicolas Rousselet: In the risk analysis we are analyzing the risk defined by the process. For example: If the parts contain channels, a thermal channel or a channel for cooling or any other type of application, in our process there is a potential risk of clinging. During the processing of the part, for example during firing, errors can be created there.

With this risk analysis we identify a benchmark in order to mitigate the risk, and apply this to our manufacturing process. We customize our process of fabrication, the 3D printing, the cleaning, and we modify the CAD file in order to take into account all the constrains. It is an iterative approach. Each step of the process is qualified and certified for this application.

After the feasibility analysis, the second step is development: We define benchmarks, we produce the CAD file with the fabrication

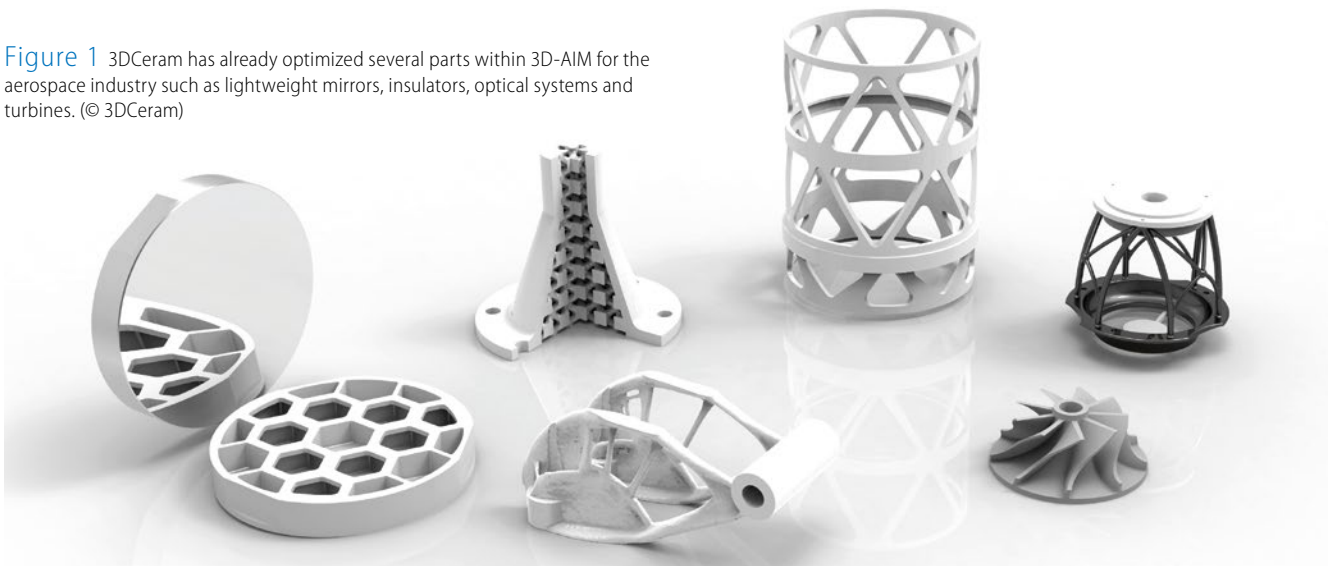

Figure 1 3DCeram has already optimized several parts within 3D-AIM for the aerospace industry such as lightweight mirrors, insulators, optical systems and turbines. (© 3DCeram)

About 3DCeram

3DCeram Sinto brings together a range of experts in the field of materials and processes for the 3D printing of advanced ceramic objects. 15 years of experience in 3D printing of complex ceramic parts led 3DCeram Sinto to build an extensive products and services portfolio, including a 3D Printer for ceramics. 3DCeram has become an engineering company that now offers turnkey solutions for the 3D fabrication of advanced ceramic parts, for diverse rigorous fields such as aerospace and aviation, the biomedical industry and luxury goods.

of benchmarks, we mitigate the risk and we determine the material and part qualifications. Determining the material qualifications is very easy as they are defined by a standard, and the part qualifications can be assessed by proof tests.

After the development step follows the third and last step, the technology transfer. At 3DCeram we have two possibilities: The first one is the production at the customer's factories. This is a full technology transfer because we sell our printers and the materials. The second one is an in-house production at 3DCeram. This is possible for a small series of parts or for a specific type of part or even a specific process. The main objective of 3D-AIM is to support the customer from the beginning of the project to the technology transfer. With this approach we are able to adapt the CAD file to our process and we are compliant with all the requirements of our customer. So 3D-AIM is a complete project, not only the fabrication of a prototype.

Could you give me some examples of projects you have already worked on?

Nicolas Rousselet: I have an example: A customer planned to print an optical support structure with the maximum printing volume. He had some mechanical and thermal requirements. We optimized the design to make the part lighter and to reduce the thermal resistance and the thermal mass. Afterwards we printed this part in our 3D printer with the addition of insets of titanium directly brazed onto it. It is therefore a complete project from the customers' requirements to the production of parts in a small series, and a perfect example for 3D-AIM.

We have also improved the design of lightweight mirrors, insulators, optical systems, turbines (Figure 1) or telescope structures (Figure 3). The lightweight mirror is a typical example for an aerospace application. It is very simple but not easy to manufacture by conventional processes, however with additive manufacturing shaping is very easy. Other examples are the lattice structures in insulators and also complex optical systems. For some parts it is possible to print them directly, for example turbine blades (Figure 2). The process is capable of near-net-shape manufacturing. Although the result is not the final part, it is a good starting point for machining.

In general, for the 3D-AIM services we have different types of customers. We have some start-ups from the new space industry and we find it very interesting to do engineering phases with them. We worked with a French start-up called Anywaves which specializes in the production of antennas for new space applications. The antenna is a device for the communication between ground and satellite. This start-up used our technology and we went through all the steps within a year. And we are currently transferring the technology to the customer to produce a large series of parts.

Kareen Malsallez: So the 3D-AIM offer can help with the conversion time from step one to step three, depending of course on the company itself. This can be between six months and more than two years, varying according to the maturity of the project. The project duration is mainly depended on the first project phase, the feasibility analysis, because we have to do tests and visit the customers site. It also depends on the resources of our customer company, whether it can provide personnel for the projects. In most cases it is the reaction time of the customer that influences the project duration.

What led you to the idea to establish this service in the first place?

Nicolas Rousselet: The new space sector is asking for the smartest answer to optimize its products. That is why this offer is initially aimed at this market. But we think that over time, additive mass production will become more prominent in the minds of industry, especially in view of the pandemic we are currently living with. That is why we think that in the coming years, this offer could really help different industries to get into additive manufacturing. 3D-AIM aims to

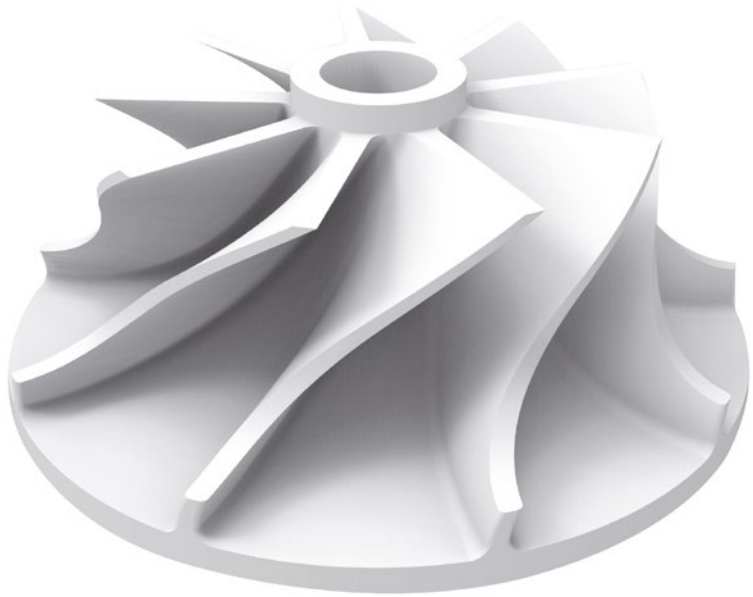

Figure 2 The process is capable of near-net-shape manufacturing, so some parts, such as turbine blades, can be printed directly. (© 3DCeram)

help the industry master the process from beginning to end. And then we at 3DCeram believe that it will be much easier to invest in this way of production. This is what we are dreaming about and why we built this offer.

Do you already have plans to further expand the service to other industries such as the medical sector?

Kareen Malsallez: Not yet. We are focusing on aerospace right now because when you go into that type of market you need to have experts. And Nicolas is our expert for the aerospace industry. If we see that this service goes right and we can answer the industry's needs, we will modify and adapt our offer step by step to other customers and markets. But first we need to fully customize this offer and respond to all customer needs.

The organizers of Formnext 2020 have recently announced that they will host the trade fair as a full digital event. What has been your experience with digital events such as webinars or digital exhibitions?

Kareen Malsallez: I think the ones we did were not very convincing and did not provide as many leads as we expected. But I think they will continue to improve their technology and that's what we are waiting for, because it's a really reactive and responsive market on the digital side.

At 3Ceram we are also thinking about digital tools, because we usually have visitors from all over the world coming to see how our printers work or attend training sessions. And we can't do that anymore. Normally, we also have technicians that go on side once a printer is sold. We have already optimized the solution to do it remotely and we offer digital trainings for our customers. So now we have a new way of working when we sell a printer. The technicians are able to install the printer remotely and train the operators and the technicians who will work on the printer. We are working on further improving this process because we don't know when we can travel again. And I think it's also the green way of working, more sustainable and also cheaper than traveling.

© Malsallez

Kareen Malsallez

Kareen Malsallez holds a Master's degree in Marketing from the E.F.A.P. Paris and started her career as a journalist. From 2007 to present, she worked as a marketing manager for various industrial markets, from the plastic injection molding industry to the metal industry and advanced technology as a block chain for a project dedicated to sustainable development. Since 2019, she is the Marketing Manager for 3DCeram.

You had to find a solution very quickly in order to react to the lockdown. Was that challenging in the beginning?

Kareen Malsallez: Yes, it was complex. But we finally found a solution. The maintenance we did remotely was something we had already done before the pandemic and the lockdown. We adapted to what the customer needs so we had those tools already. But usually customers feel more secure if they can come on site because it is a new tool, a new technology. So they also have to adapt on their side and learn to accept remote installation.

A general question: What fascinates you most about 3D printing?

Nicolas Rousselet: I think the amazing thing about 3D printing is the fact that it's in high demand. There are applications in aerospace, medical and even kitchen appliances and other types of applications. I think it's not just a new process, it's a new paradigm for society because it's possible to produce a new design and a new type of product quickly and locally. And I think it is simply a revolution, a new way of producing a part, not just a process.

What was the compelling point that brought you into the 3D printing business?

Nicolas Rousselet: For me, 3D printing is very interesting because it's very rare to be at the beginning of an industrial revolution. I was a mechanical engineer for the space industry for ten years, and during my time at Safran and Airbus, I had already produced some metal parts by additive manufacturing. And 3DCeram has a very good process for the additive manufacturing of ceramics.

Thank you both for the interview.

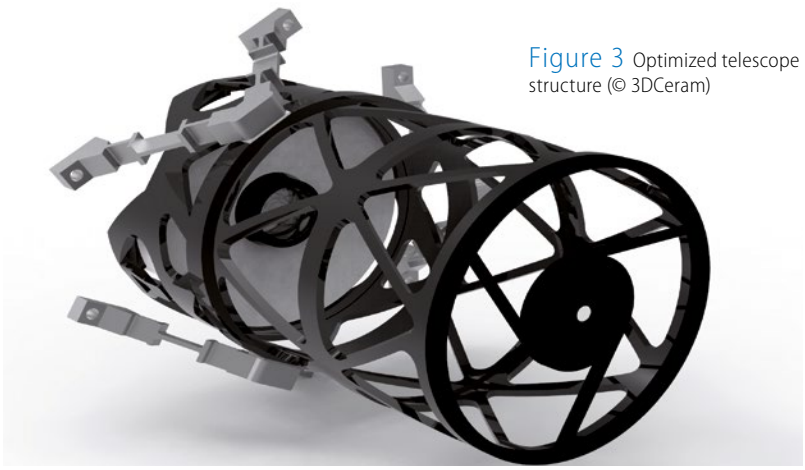

Figure 3 Optimized telescope structure (© 3DCeram)