GERMANY

Fusion Factory from XERION: Flexible – Fast – Cost-Efficient

Dr Uwe Lohse established the company XERION Advanced Heating Ofentechnik GmbH in Freiberg/DE in 1997. In the year 2016, the subsidiary XERION Berlin Laboratories in Berlin/DE was founded with the goal of advancing the process of 3D-printing. Together, the companies now form the XERION Group. Fusion Factory from XERION consists of a module with FFF/FDM printer, which can process both metal and ceramic filaments, the downstream debinding and sintering unit as well as a control module.
Dr Uwe Lohse (UL) reported to us on the concept of the plant and the development possibilities for the use of this technology.

Fig. 1
Dr Uwe Lohse

CA: *In over 20 years operating activity in research institutes and industrial enterprises, XERION has made a name for itself in specialist furnace engineering with high-temperature furnaces for various atmospheres and vacuum. What motivated you to work with additive manufacturing?*

UL: In 2016, XERION Advanced Heating Ofentechnik GmbH/DE started a joint project with the Fraunhofer IFAM/DE for the development of an innovative, additive-subtractive manufacturing concept for generative production of metallic replacement parts. The goal was the development of a complete production line for the production of metal and ceramic components by means of FDM/FFF. The focus is on mobile applications for the production of replacement parts as well as innovative approaches for multimaterial components. For this reason, our Fusion Factory is built to be very compact and would, in this respect, be suitable for use as a mobile installation.

Of particular interest in this project are metallic materials that are difficult to process with conventional, transformative and machining processes. The goal was also the set-up of a prototype manufacturing line, which is attractive because of its price/performance ratio and a so far unknown flexibility for SMEs and assures competitiveness in the sector of generative manufacturing. In the scope of this project, we were able to bring in our decades of experience in debinding and sintering.

CA: *Which of the printing systems now available was taken as a basis?*

UL: In the course of the project, the commercial, filament-based 3D-printing systems were further developed for the production of metallic components. A metallic filament suitable for commercial printers. The printer has now been modified so that high-filled filaments can be processed in a reliable process. At the same time, it was achieved that all process-relevant data of the printer and the other modules can be recorded and documented. and accordingly, a "digital twin" can be formed over the entire process. That is essential in respect of process capability in the sense of Industry 4.0.

CA: *Which goals had you set in respect of the materials?*

UL: We have developed a debinding concept that is based on solvent (non-catalytic) debinding. The filaments are prepared like feedstocks for the PIM process and are available commercially from suppliers. In respect of component production, we are very flexible and build the metal, ceramic or composite component on a platform measuring 20 cm x 20 cm. Both components with high densities between 98–99 % and selectively adjusted porous structures can be produced. Particularly interesting is, in our view, to develop multicomponent parts. For this, we equip the printer with up to four nozzles. The material pairs have to be selected according to the usual criteria, like thermal expansion and sintering behaviour. These nozzles do not necessarily have to be used for different materials, they can also be advantageous as a pairing to further process quickly if a coil has to be retrofitted with filament. We have adjusted

Fig. 2a
Fusion Factory

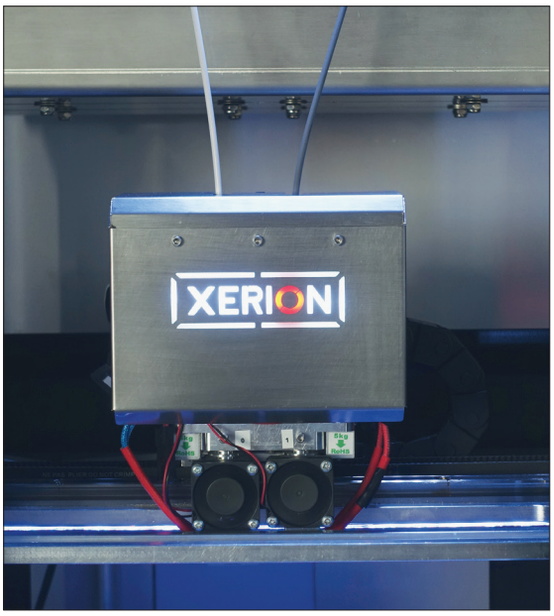

Fig. 2b
Printing station

the nozzle geometries to corresponding filament types. Our sintering furnace module is suitable to work in hydrogen, nitrogen, air or vacuum, This concept of the multi-atmosphere sintering furnace was also redeveloped on the basis of the many years of expertise in XERION furnace engineering.
Of course, we can also deliver individual modules in the Fusion Factory if the customer already covers one of the process steps.
CA: *Where do you see the most important applications for the new Fusion Factory?*
UL: At present, we are working especially closely with universities and research institutes. Of course, my lectureship at Freiberg University of Mining and Technology/DE benefits me here. The process will increasingly find its way into industry as the advantages of high flexibility, coupled with speed, will lead to considerable cost reductions in prototyping.
As materials, currently alumina, zirconia, stainless steels and various carbides are available. We have created a separate warehouse to constantly guarantee high availability for us and our customers. In the plastics sector, 3D-printing is generally further developed because the process chain in simpler and enormous sizes can be achieved. PEEK materials are very temperature-resistant and, unlike earlier, can therefore compete with other materials.
For users, the performance of the materials, but also the timeline in the production of components are important. It concerns applications in different areas of medicine as well as the automotive and aviation industries.
The application of multimaterial components cannot only be seen in technical areas but also in respect of aesthetic aspects for decorative elements, e.g. in cars or as pieces of jewellery. In our cooperation with Berlin University of Arts/DE, I have close contact with creative young people to whom I like to make our system available to produce objects. In this way, objects are created that are free from the constraints of the production techniques available up to now. For technical applications, too, in product design we have to learn to think much further on the horizon of possibilities.
CA: *Thank you for talking to us.* KS

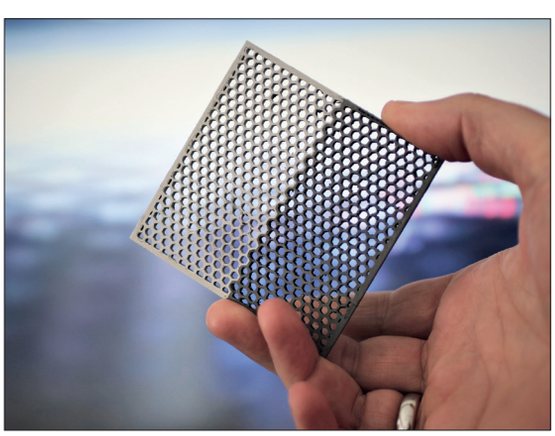

Fig. 3
Printed metal-ceramic honeycomb

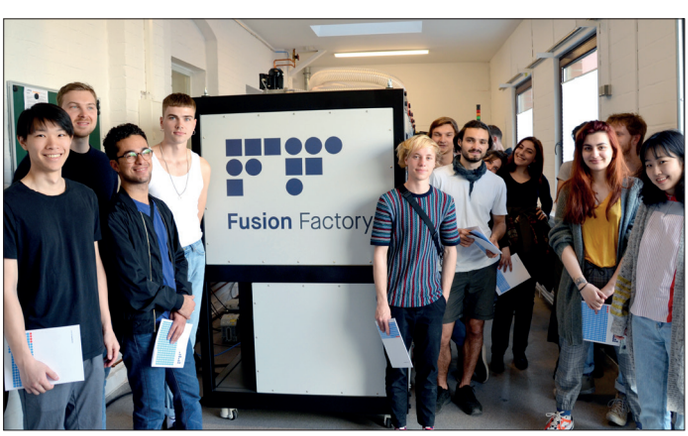

Fig. 4
Visit of students from the Berlin University of Arts