

FRANCE

# 3DCeram Sinto: Ceramic 3D-Printing Goes on Industrial Scale

In 3 years time, Additive Manufacturing (AM) in ceramic evolved a lot. Many mixes have been developed, many new equipment are on the market and still new AM technologies are in the R&D status. But one should keep in mind that the potential boom of this market will only occur if machine suppliers can provide industrial and automatic lines and not only small machine for development purpose. At ceramitec 2018, 3DCeram Sinto has presented at the Day of Technical Ceramics organised by CERAMIC APPLICATIONS a 3D printing industrial and automatic line. Richard Gaignon (RG) summarized in an interview the progress made in AM in the last 3 years.

**CA:** What has changed in three years time in 3D-printing of ceramics?

**RG:** Three years ago, in 2015, I was presenting the SLA technology at the biggest ceramic fair in Europe: ceramitec. An amazing crowd of 150 people was attending. They all loved this new technology, they all loved the concept but soon the

following questions came: is it a real technology? What are the markets? Is it only a toy for University and research center? Three years later, I did the same and the reaction was quite different: no need to convince about the interest of this technology, we could see 3D-printed products everywhere as well as 3D-printing technologies.

Even if ceramists are conservative people, they had to admit that 3D-printing for metal and plastic was entering the world of industrial company. GE, HP, and many others are massively investing in.

According to Terry Wohlers 2018 study, the worldwide market in metal AM (service for parts and equipment) has reached USD 7500 million in 2017.

**CA:** What are the prospects for ceramic 3D-printing ?

**RG:** According to Smartech survey, the ceramic AM is as developed as for the other materials but the development is expected to occur in the following years. All depends on how fast the market leader (technical manufacturer) will adopt this technology. Two scenarii are existing. Either the additive part market will be USD 1227 million or only USD 56 million in 2027. Which market are pulling this growth? Biomedical, space, energy. The automotive sector will be starting soon as major players of this field are investing. For instance, Bosch/DE bought a machine of 3DCeram Sinto.

**CA:** The market is adopting the technology but how will it be possible to speed up the process?

**RG:** There are two type of actions to be taken to speed up this process.

First, we all say "ceramic" as a generic name. But we have to remember that ceramic material covers a large diversity of materials. There are so many different type of ceramic material and all are not printable by SLA technology (either the process does not allow or the price of this technology is too high). The more mix are developed, the more markets can be addressed. 3DCeram Sinto had 3 mixes in 2017. In 2018, the number of different types of mixes went up to 12. It includes oxides materials and non-oxide materials such as silicium nitride and aluminium nitride. By selling equipment to research center, this gives us the possibility to develop standard mix faster.



Fig. 1  
Christophe Chaput (l.), and  
Richard Gaignon (r.)

Also, 3DCeram Sinto is proposing an on demand solution for the Technical Ceramic manufacturer who does not want to change its ceramic. The manufacturer just has to send its powder, and 3DCeram Sinto develops the mix and the printing parameters on the CERAMAKER machines.

Having more mixes is a must, but the biggest demand in the industry is to have an industrial line. Today, the market of SLA is dominated by small bottom up machines with many manual operation: parts have to be taken from the machine, supports have to be manually removed, parts have to be set in the “relaxing” chamber then changed to the debinding kiln then to the sintering kiln. If this could be convenient for research center it is a clear NO GO for industrial manufacturer. Therefore, 3DCeram Sinto has developed an industrial and automatic line: 3DCeram 4.0.

**CA:** *What is this 4.0 line about?*

**RG:** Actually, we took the best of the CERAMAKER and 2 years ago, we started to work on an automated line. The result is simply fascinating. Almost no human presence is needed. The printer is based on the CERAMAKER C9. The 3 major changes are:

1. Mix is loaded from the outside and thus no down time to reload the material,
2. Recoater can automatically make its zero adjustment;
3. The machine can be loaded and unloaded automatically.

The line is completely automatic, including cleaning of the parts. Still one person is needed to remove the part from the printing tray, in order to do the final control and set them onto the fired setters.

At the end of the process, the unpolymerized paste will be recovered from the printing tray and automatically set into the mix dispenser.

The robotic arm is taking the tray with the parts from the CERAMAKER, put them either in a waiting platform or directly into a cleaning booth. Once the parts are cleaned, it goes into a stationary platform, where one operator can finalise the cleaning and move the parts from the printing tray onto the firing setter. These setters are automatically set in the kiln. For the kiln, 3DCeram Sinto has developed several concepts in cooperation with different companies. The most improved one is the auto-reverse kiln. This kiln is a double bell type kiln. One side is used for the debinding and the other side is used for sintering. The biggest advantage of this kiln is that there is no need to cool down the product after debinding and they can be directly set into the sintering kiln. It saves time and energy. With this setting, the total time for debinding and sintering can be reduced down to 34 h compared to 120 h (or 200 h at our competitor). As an option, the kiln is equipped with a catalyst cleaning gas system. In the meantime, the automatic system will continue to operate the rest of the line. No manual operation, a high efficiency, no down time – these are the main characteristic of this 4.0 lines.



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Fig. 2  
4.0 line

Of course, the layout has been designed to give the possibility to add one additional printer and or one kiln.

**CA:** Needs the machine technology and 3DMIX to be developed at the same time?

**RG:** Developing a new 3DMIX on printing technology which can not be up scaled is clearly a waste of time. Printing parameters depends on the mix itself, AND on the technology. Therefore, if one does not want to develop twice the parameters and the mix, it is better to start with the proper machine.

This new 4.0 line, is fully compatible with the multi-material machine CERAMAKER Hybrid and then can be foreseen for multi-material purpose. It means that the C9H can print several material at the same time such as ceramic/ceramic (same ceramic but different density or different ceramic) ceramic/metal (for electronic application such as HTTC, LTTC) or ceramic/resin as the resin will be burned during the debinding process, and thus no need of the cleaning phase. It is a key of success to choose the proper technology at the beginning which can be up scaled and automatized.

**CA:** Thank you for talking to us.

KS

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