

3D PRINTING HYBRID PARTS

The 3Dprinting of technical ceramic opens a new and large landscape for innovative applications. Manufacture complex ceramic part is now possible with ease without tooling costs. The capabilities of the 3Dprinting process are huge and new applications are emerging. The new concepts are more efficient and more compact.

The next challenge of the additive manufacturing is the multi-material printing. Indeed, the devices are more innovative, but some companies are looking for a solution to print some materials together.

Among all the field of applications, the electronic devices domain is the most promising. Embedded electric path into a ceramic part establishes a new disruptive and innovate approach in this domain.

Some applications like IOT (Internet Of Things) needs this technology to develop smart sensor on some everyday objects.

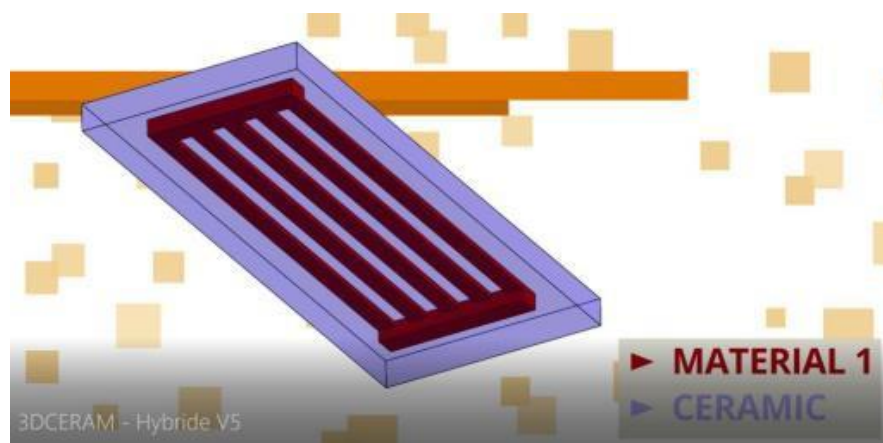
3DCERAM has developed the hybrid process to address those challenges. The hybrid process is not a new machine but an update of the current 3D printer. This approach increases to process flexibility and reduce the cost development of hybrid applications.



Hybrid 3D printing process

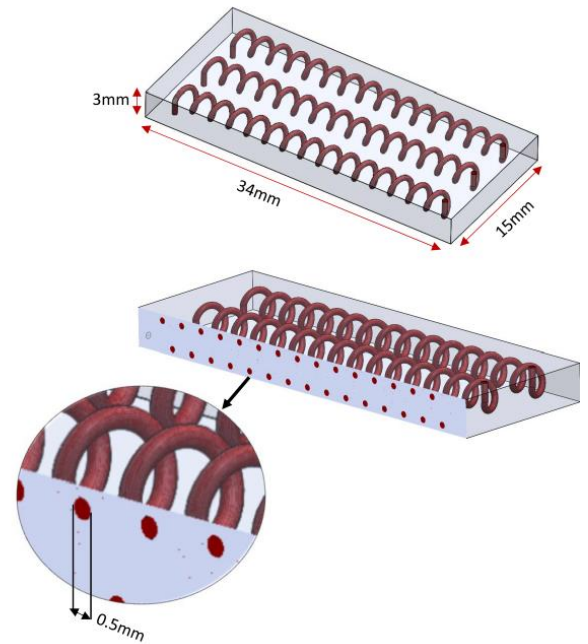
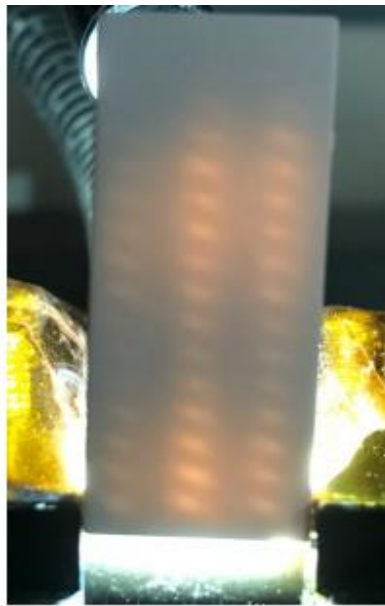
The hybrid process is made possible by the addition of a hybrid scrapper on the current 3Dprinter. This device is equipped with a dispensing system. 3DCERAM proposes several dispensing systems depending to the application and the associated requirements.

At the process point of view, the hybrid 3D printing process builds the part slice by slice for every material. The ceramic material is spread by the scrapper (SLA process) and the UV laser will polymerize the first slice. Afterwards, an air jet will remove the section of the other materials. The dispensing system will fill the gap generated by the air blowing with the other material. The others material could be also polymerized by the laser but this operation depends to the type of the filler material.



Conformal embedded coil in alumina

Hybrid process is particularly innovative for electromagnetism application like embedded coil in an alumina part. The picture below shows a benchmark adapted to this application. Small metallic solenoid is embedded into alumina part by additive manufacturing. The current resolution is close to $\varnothing 0.5\text{mm}$ but it can be improved by a more precise dispensing system.



The hybrid process opens some new type of application like the bitter coil. The technology is well adapted to the future challenge of the transport electrification (magnet wheel motor). Indeed, the bitter coil is complex even impossible to manufacture by conventional manufacturing process. The 3Dprinting process is able to manufacture some type of devices with a perfect customization to optimize the performance.

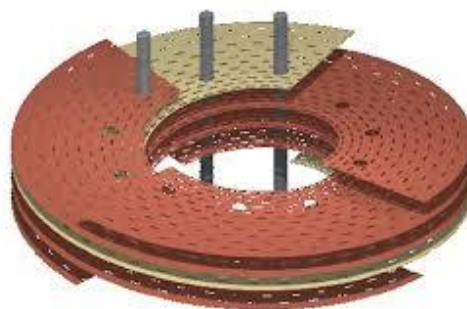
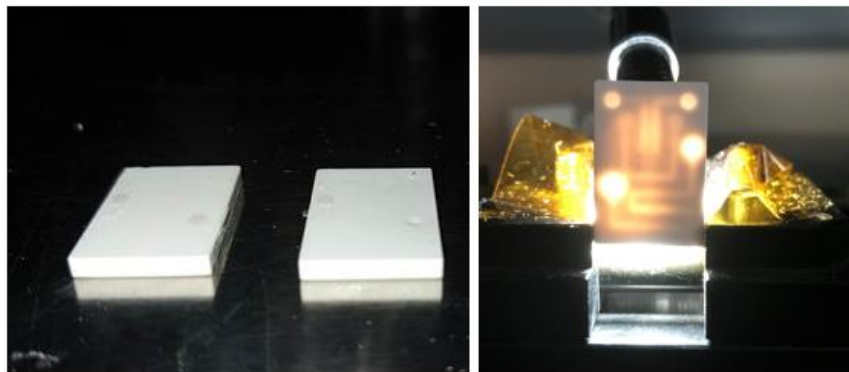
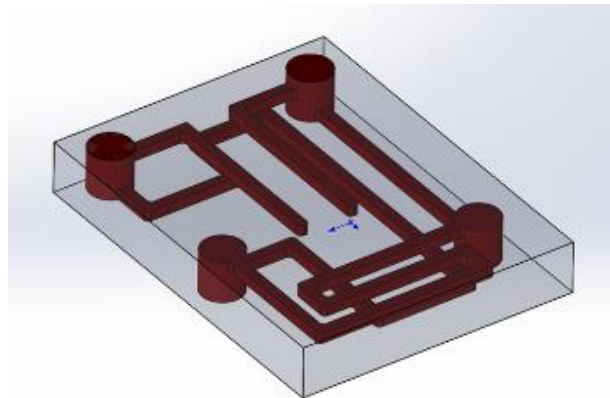


Figure 1 - Source : <https://www.ru.nl/hfml/research/levitation/diamagnetic-levitation/bitter-solenoid/>

Electronic devices

Hybrid process finds a perfect application in electronic and sensors industry. The free path possibility increases the electrification density of the electronic devices. The hybrid process is also a good process for quick prototyping of ceramic PCB, LTCC (Low Temperature Cofiring Ceramic) or HTCC (Hot Temperature Cofired Ceramic). This approach reduces the time and cost of developments for innovative applications. The picture below shows a benchmark with some electric paths on alumina.



Conclusion & perspectives

The hybrid process is an important technological brick for the next generation of electronic applications using the 3Dprinted ceramics. 3DCERAM has developed this technology for the industrial 3Dprinter C900 but also for laboratory with the C100. This strategy allows a quick development of some application, reduced the time and development cost and make a scale up for the mass production.

The market tends to develop the 3Dprinted electronic for some innovative applications for the IOT market and embedded electronic and 3DCERAM has created the best development platform to reach the objectives.