

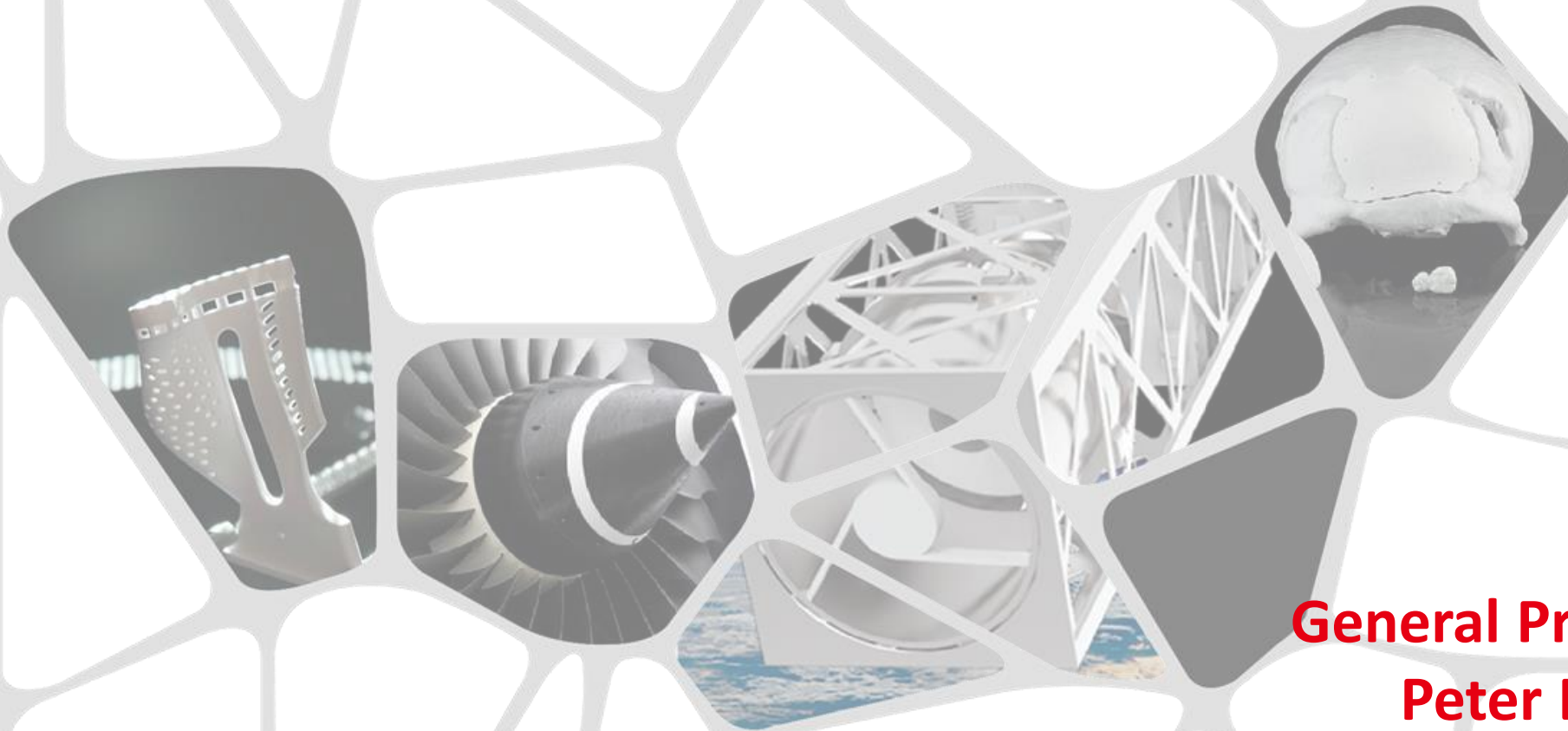


sinto

3DCERAM

New Harmony >> New Solutions™

3D PRINTING TECHNICAL CERAMICS



**General Presentation
Peter Durcan**

How to succeed in 3D Printing ?

SLA
Technology

Technical
ceramics
formulations

Process
mastery

Strategic
location

Strong history
of
collaboration

Industrial
partners

→ Limoges, France

→ IRCER
(National Research
Institute for Ceramics)

→ Sintokogio

3DCERAM

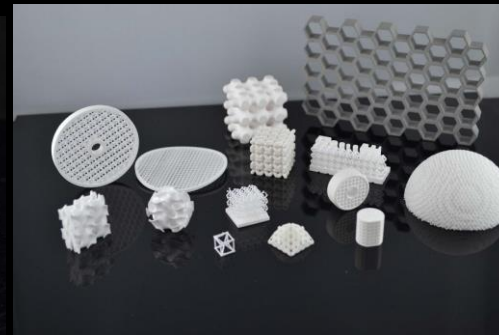
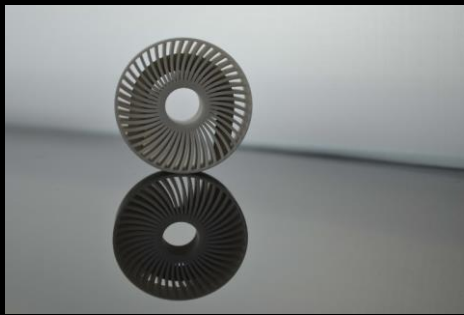
PRINTERS



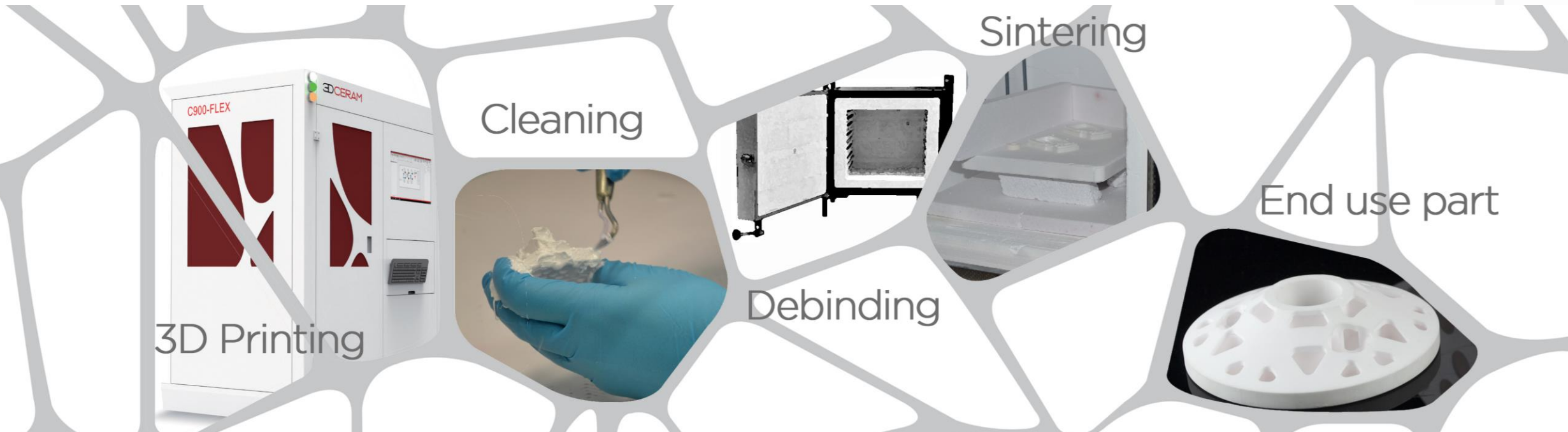
FORMULATIONS



PARTS



3D Printing Process



We support our customers throughout the process: from 3D printing to end use part

Stereolithography (SLA)

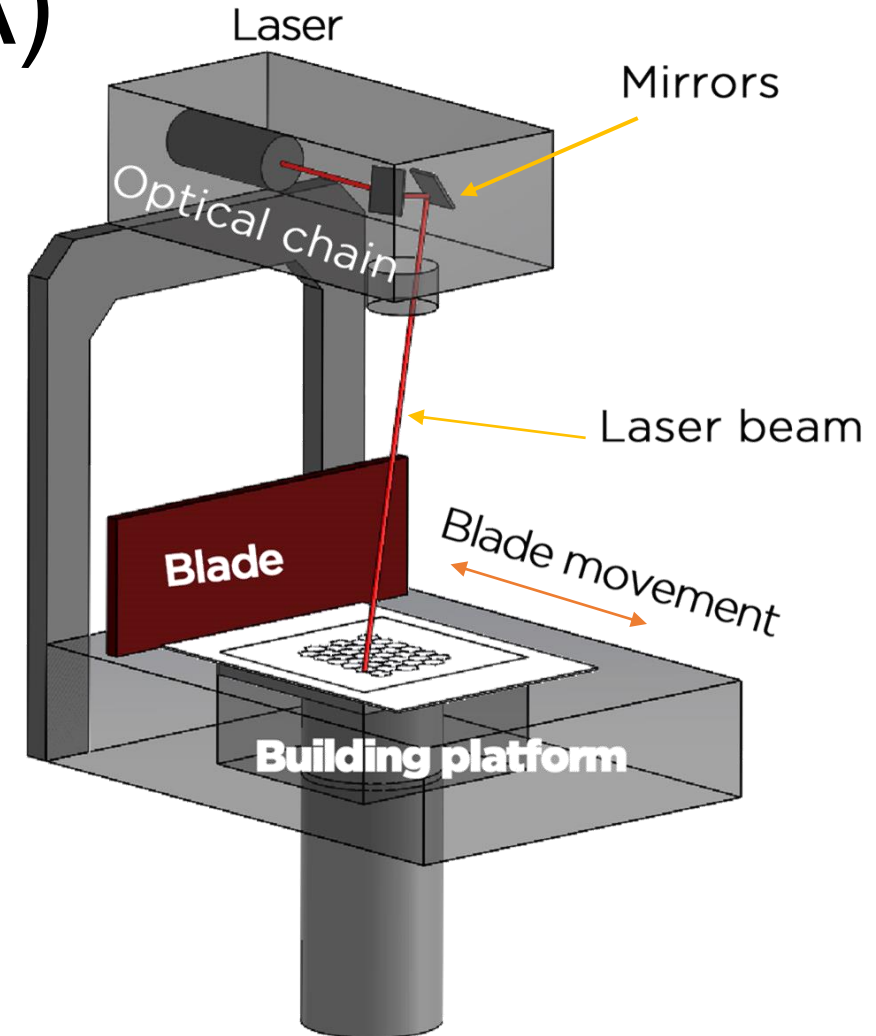
Enables **Top-down** printing



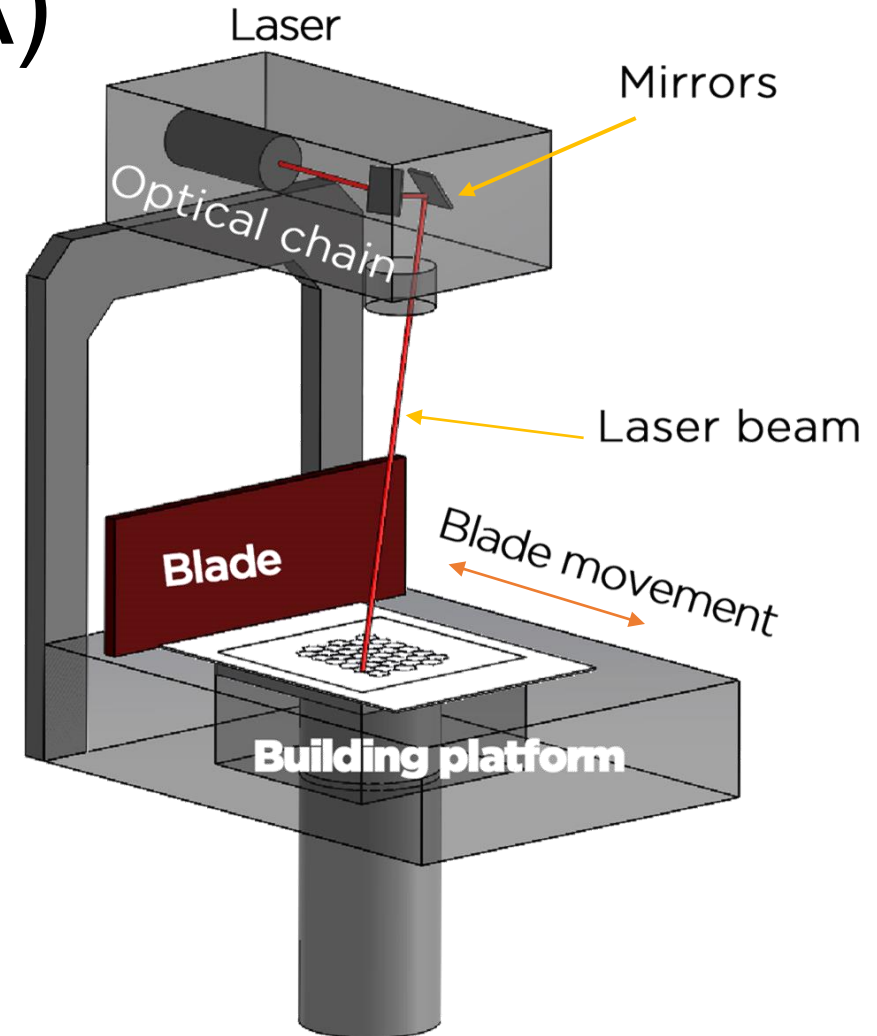
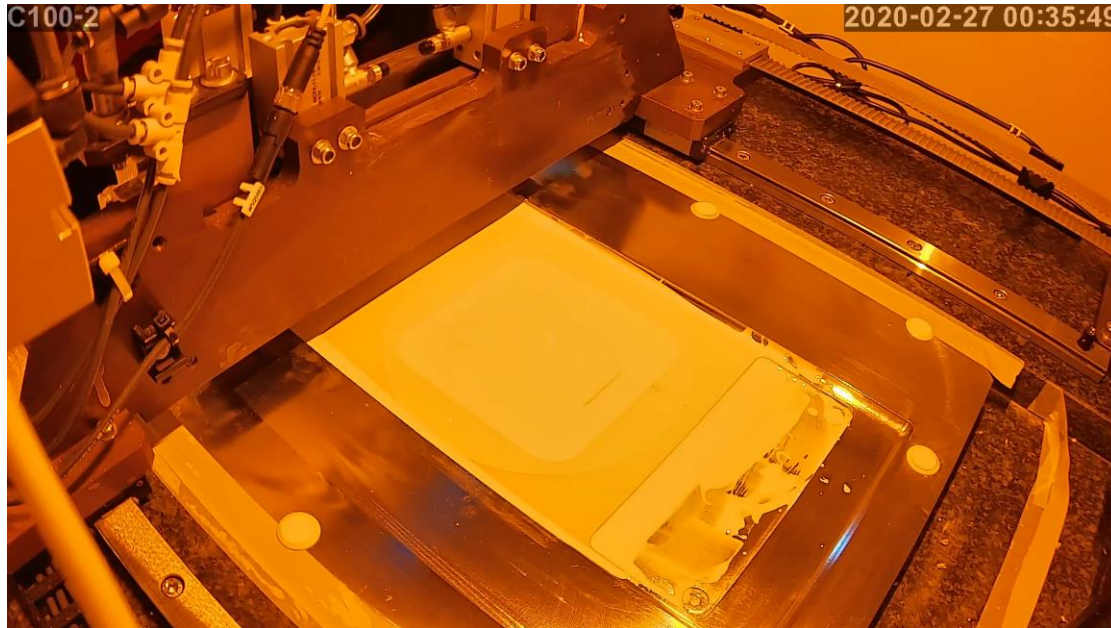
Technology lends itself to uniform shrinkage



Precision & fine details in final part



Stereolithography (SLA)

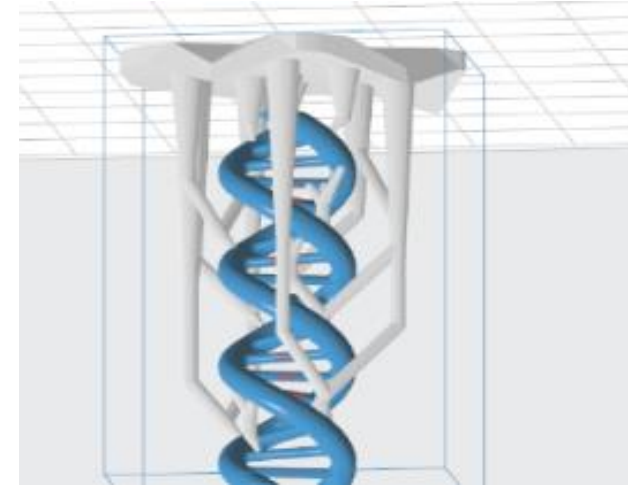


Top down

- Avoids potential for delamination issues
- Orientation allows for specially developed support structures
 - No additional tooling required to remove supports

VS

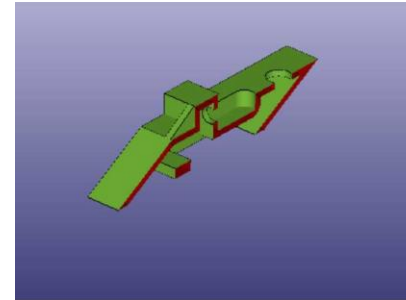
Bottom up



- **Attached supports** are **necessary** with the bottom up printing orientation.
- **Tooling** is required for cleaning stage and post processing.

Stripping Support

- Easy to implement
- CAD time saver
- Easy to clean
- No tooling
- Suitable for all types of shapes, provided there is no risk of deformation



STRIPPING SUPPORT BY 3DCERAM



Free Link Supports

- 🌀 Exclusive to 3DCERAM
- 🌀 Print the part and a support simultaneously
- 🌀 No link in between
- 🌀 Sintering step on the support → to keep the shape and avoid any deformation on the part

FREE LINK TECHNOLOGY BY 3DCERAM.



Patented

3DMIX

BY 3DCERAM

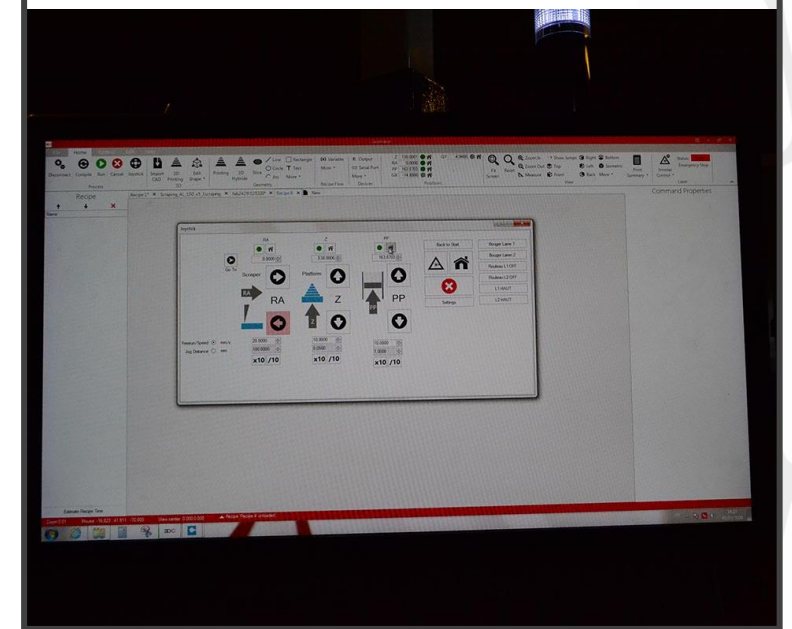
STANDARD



ON-DEMAND



OPEN PARAMETERS



Ceramic Materials

Oxides

Silicore
Alumina toughened zirconia
Cordierite
Zirconia 8Y
Tricalcium Phosphate (TCP)
Fused silica
Zirconia 3Y
Hydroxyapatite (HAP)
Alumina
...

Non oxides

Nitrides

Silicon Nitride
Aluminium Nitride

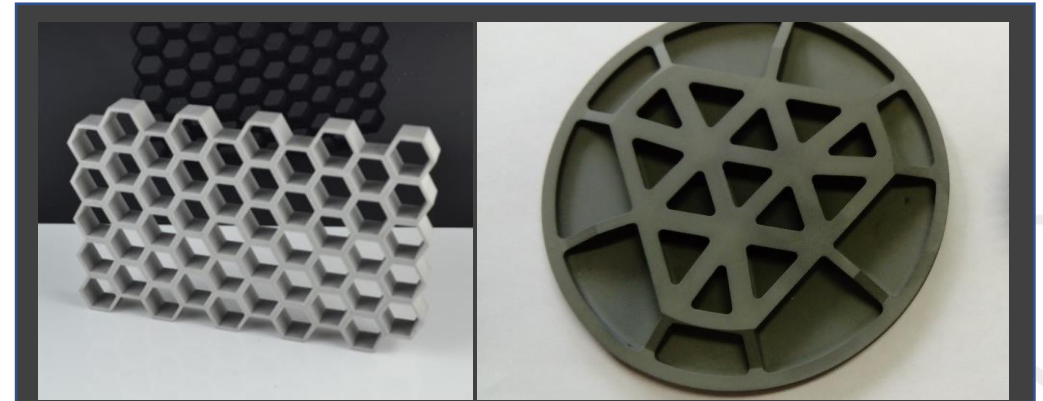
Carbides

Silicon Carbide
(In progress)

Markets & Materials

Aerospace

AlN & Si₃N₄



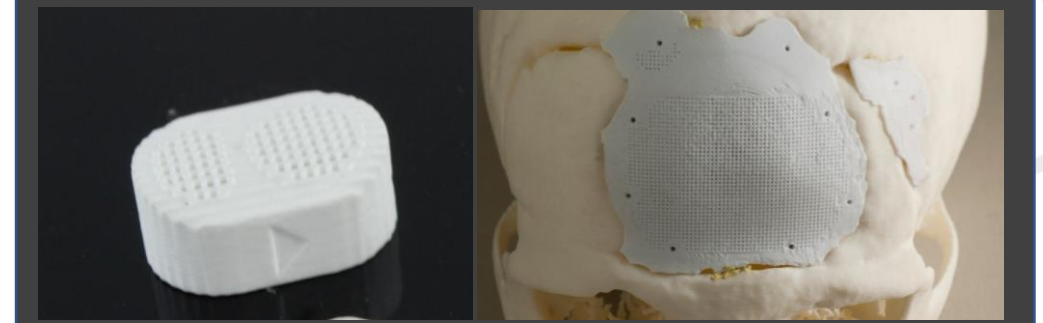
Industry

Silicore & Zirconia



Biomedical

HAP & TCP



3DCERAM[®]

A range of 3D printers for ceramics



C100EASY
For labs &
research centers

C900 FLEX
From lab to fab

C3600 ULTIMATE
For mass production

C100 Easy: Research & Process Maturity

UNIVERSITY
RESEARCH
CENTERS



PROTOTYPING

OPTIMIZED PARTS



INDUSTRY
MANUFACTURERS



SCALE UP FOR MASS
CUSTOMIZATION

PRODUCTION FOR
SMALL PARTS

Take your first step into 3D Printing technical ceramics and increase your process skills with C100 EASY

C100 EASY: Prototyping an Optimized Part

Heat exchangers are a great challenge for several industrial markets

→ Need to increase part performances.

In this example the part is built in one piece with internal channels, possible only with 3D printing.



Heat exchanger

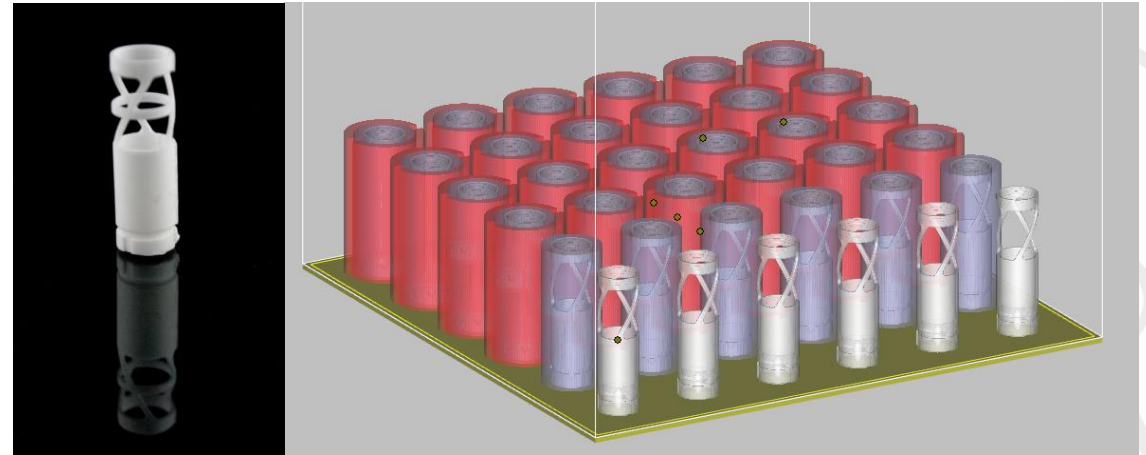
C100 EASY: A Case Study

User friendly and **fast** printing process opens opportunities for production-

Small parts of high value

or

Parts with dimensions of
100x100x150 mm max/per run

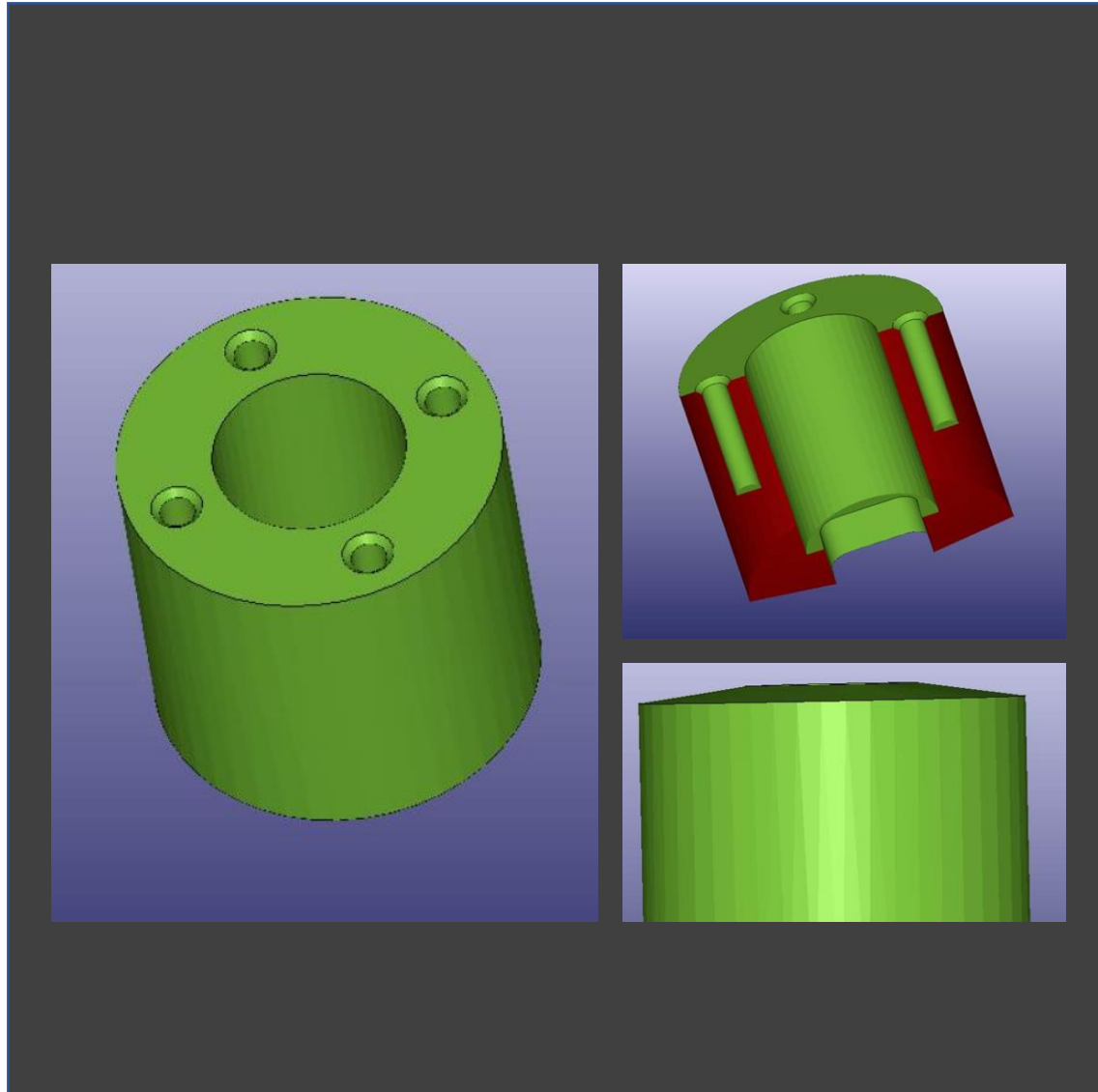


Example of Micro turbine

ROI Case Study

- 600 parts per month
- Currently done by machining: \$50/part
- With the C900: \$30/part
- With the C3600: \$17/part

Mass customization with the C3600 ULTIMATE is cost efficient

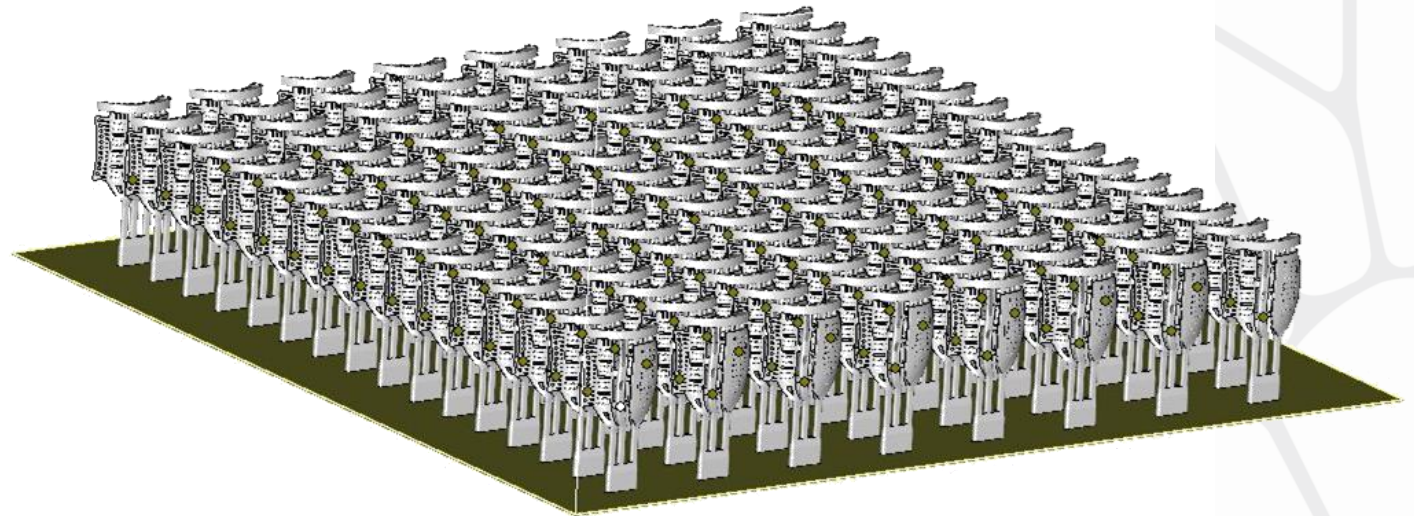


Mass Customization

Foundry cores

A perfect example of additive manufacturing interest in a consumable context :

- 🌀 A complex part
- 🌀 Ceramic material required
- 🌀 Save manufacturing *time* and *cost*



3DCeram Services

A range of 3D printers for ceramics



C100-EASY
For labs & research centers

C900-FLEX
From lab to fab

C3600-ULTIMATE
For mass production

Aftersale & Maintenance

ESSENTIAL PACK
SERENITY PACK



Optimization

PERFORMANCE PACK
AUDIT PROCESS

Each pack is customized per printer

Services Adapted to Each Printer

C100 EASY

C900 FLEX

C900 HYBRID

C3600 ULTIMATE

Aftersales packages : maintenance, phone support, mechanical & laser assistance

- From lab to fab : Prototyping process
- Stripping support
- Free link technology

- From lab to fab : Prototyping process
- Design support to cultivate expertise
- Stripping support
- Free link technology
 - Audit process

- **Multi-materials 3D printing**
- Prototyping process
- Design support to cultivate expertise
- Stripping support
- Free link technology
 - Audit process

- **Mass production**
- Tank optimization
- Stripping support
- Free link technology
 - Audit process

3D-AIM Raise 3D Printing to Maturity

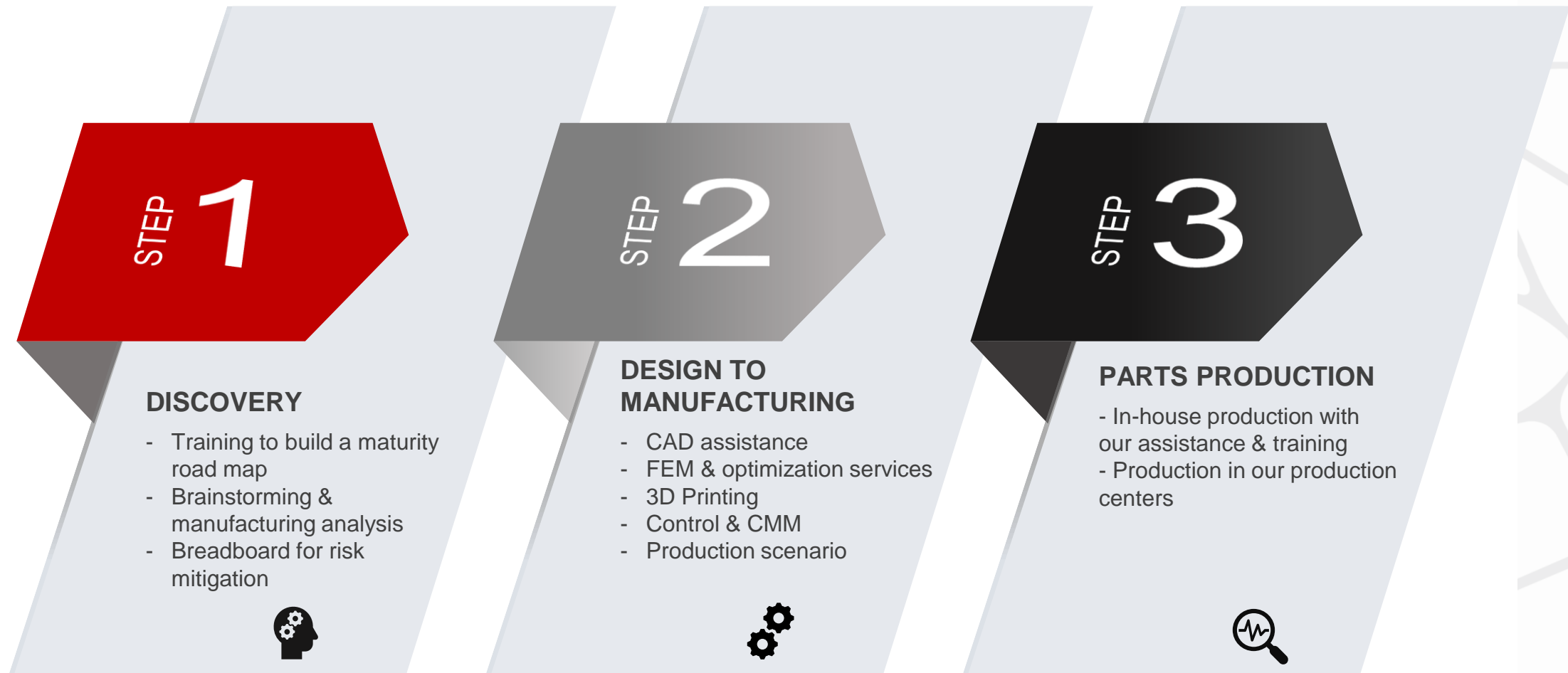
Reach the maturity of the **high technology product**

We develop a **co-design approach**, allowing you to enjoy the **benefits of 3D** printing while managing

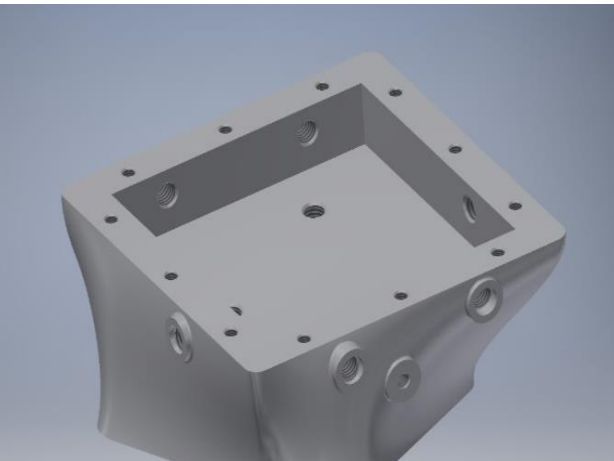
the complexity of parts and constraints specific to the 3D printing in ceramics.



Steps to Program Maturity



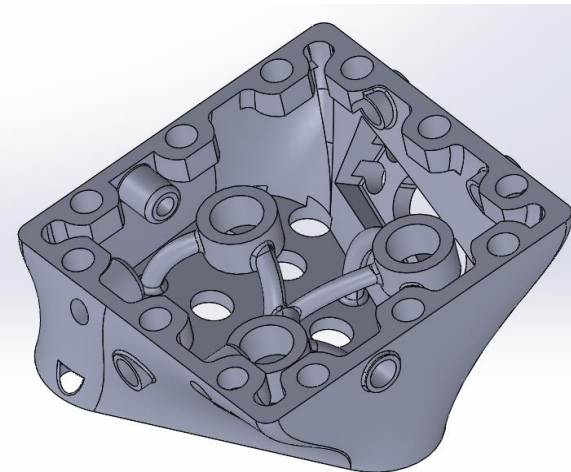
Design Case Study: Optimizing an Alumina Mirror Support



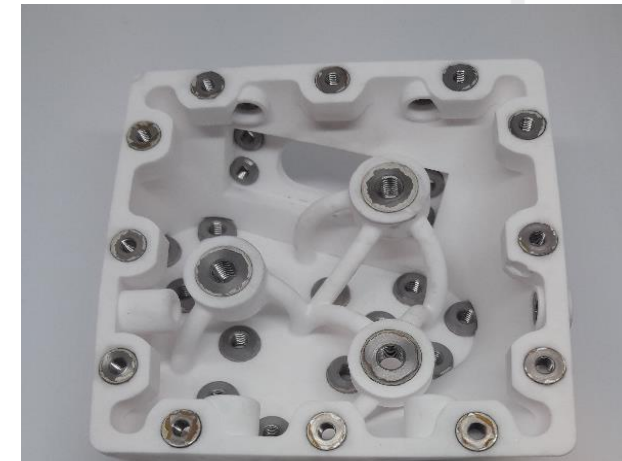
Allowable volume



After 3D printing



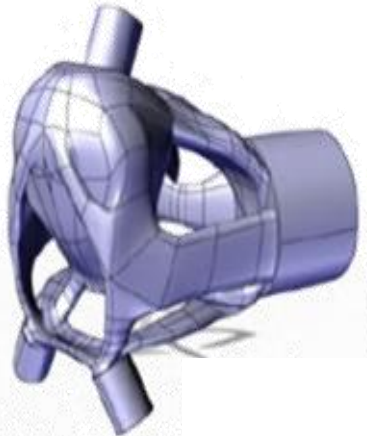
Optimized design part



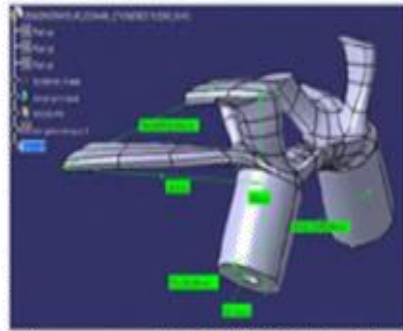
After sintering and insert brazing



Case Study: Hub Space Si_3N_4 Structure



END PART



REDUCE MODEL



3D printing benchmark

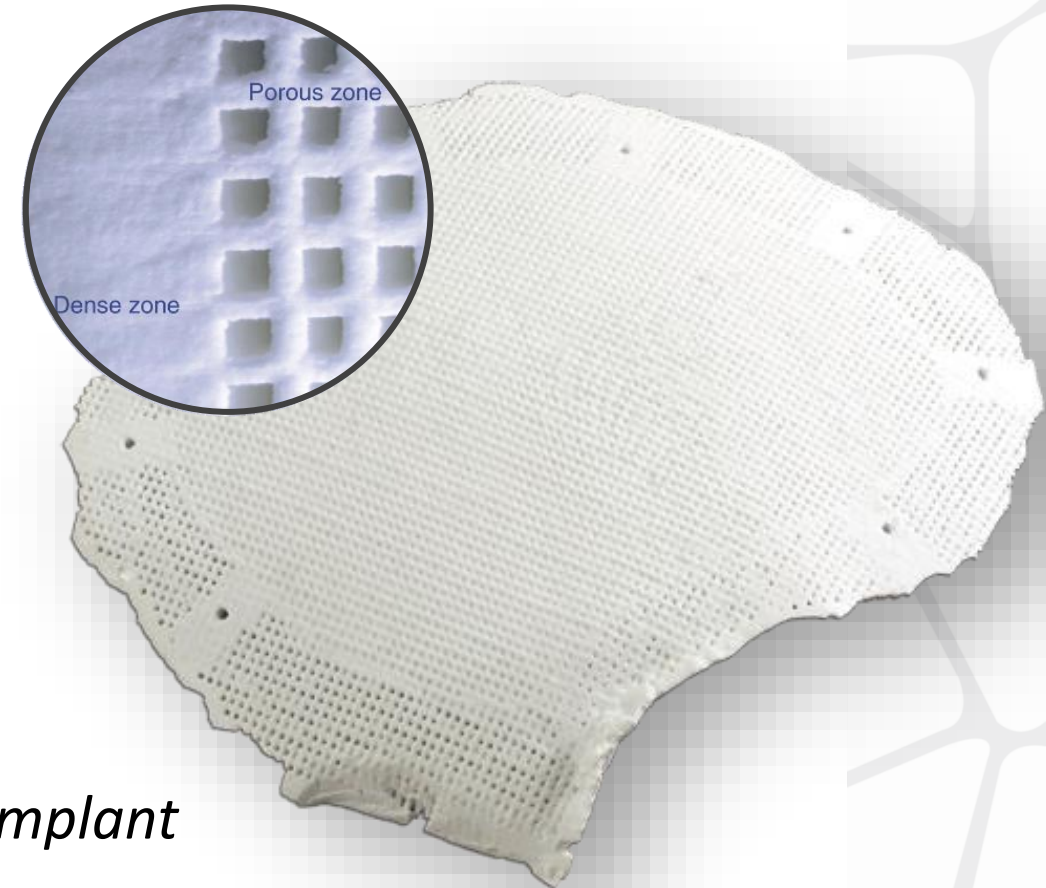
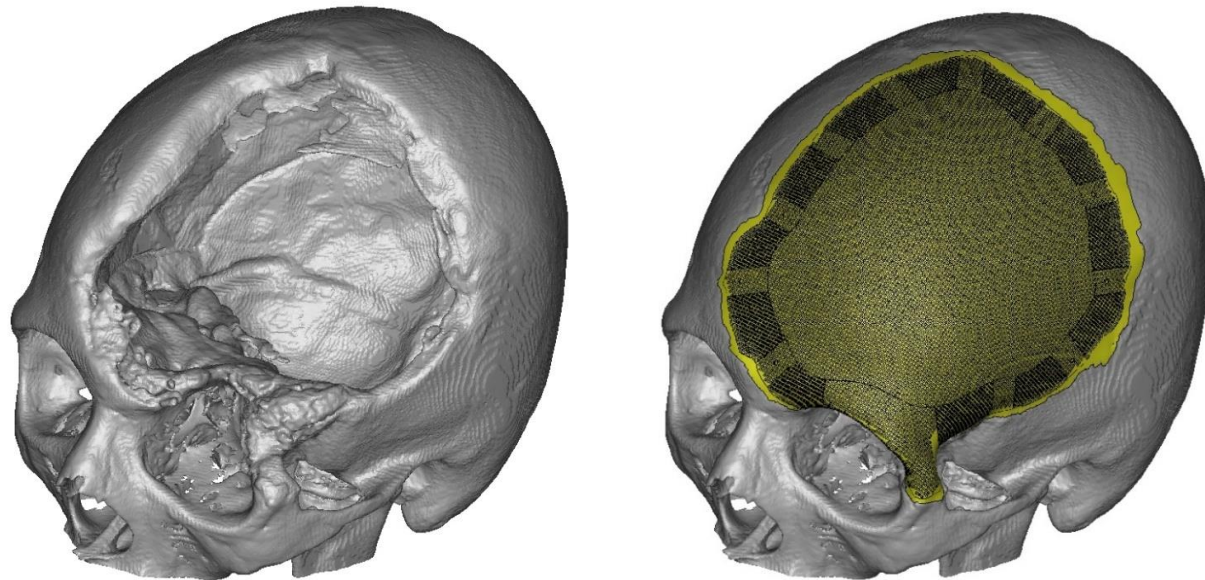


3D printed part to demonstrate feasibility



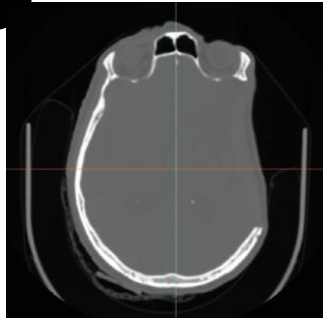
Biomedical Case Study: Skull Implants

A 2005 study conducted in partnership with CHU Limoges



Porous and dense areas combined on the same implant

1



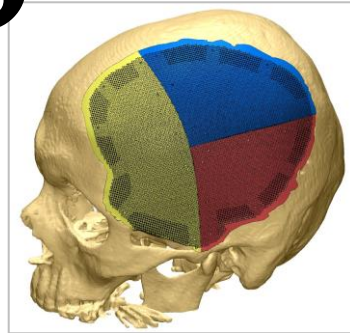
Scan from the hospital

2



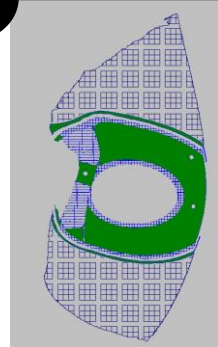
3D Reconstruction

3



CAD Design

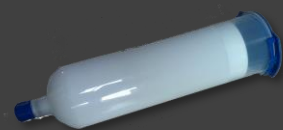
4



3D Printing Pre Process

6

SLA printing



Ceramic formulation

5



7



Cleaning

8



Debinding - Sintering

9



Geometry check on the skull model

10



Sterilization and Packaging

Coming soon...

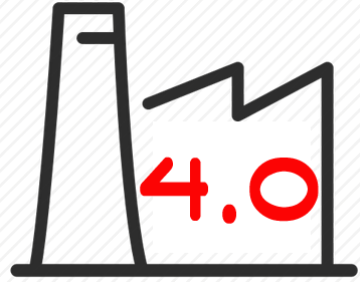
C1000 GO FAST

Building platform : 320*320*200 mm

- ⇒ 1000 mm² of printable area
- ⇒ Fast printing marketing position

Launch end 2022





3D Printing & Industry 4.0

Since 2005, we've developed technology to enable companies to succeed.

Time to market

- Strong connection between step in the process
- Better efficiency on the whole value chain, from the design to the final control
- Easy batch management

Machine downtime

- Reducing of the lost time between several process
- Better management of the manufacturing process

Yield loss

- Mastering Yield loss
- In-situ process control for quick detection of issues during 3D printing
- Lower material waste

**MORE CAPABLE.
MORE PROFITABLE.
MORE USER-FRIENDLY.**





sinto

**ADDITIVE
MANUFACTURING
ECOSYSTEM**

- 3DCERAM
- 3DCERAM Inc
- 3DCERAM China
- VCERAX Japan

A Worldwide Presence





Thank you for your attention

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Business Development
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