3D RestaurAM - Implementation of 3D additive printing technologies to the promotion and restoration of Valencian heritage.

Beneficiary entity:

Asociación de Investigación de las Industrias Cerámicas (AICE). G46271144

File: IMDEEA/2019/81
Program: PROMECE – Plan de ayudas a Institutos Tecnológicos
Actuation: IMDEEA-PROYECTOS DE I+D EN COOPERACIÓN CON EMPRESAS
Duration: 2 years (2019-2021)

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General objective

The general objective of the project is to develop **3D printing materials** for the manufacture of parts for the field of **restoration and promotion of the Valencian heritage**.

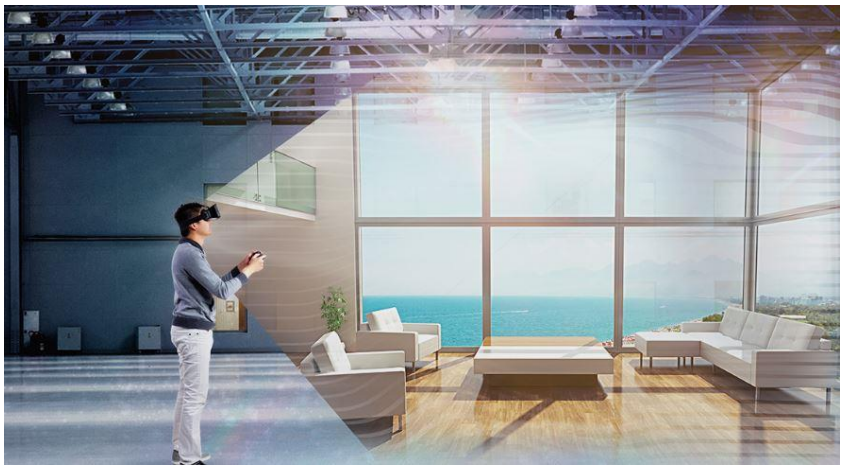
Specific objectives

Five main points will be developed:

- Execute a practical case through scanning and 3D modelling of application to the Valencian architectural heritage.
- Select the 3D technologies for the manufacture of architectonic parts.
- Develop materials for the selected technologies.
- Carry out printing and prototyping tests.
- Study the viability of the ceramic materials for the selected technologies.

Ultimately, the aim is the transfer, adaptation and application of the new manufacturing technologies to the sector related to the conservation and restoration of the Valencian heritage. The positive result of the project could mean a great advance in the promotion and restoration of the Valencian heritage.

1.- Scanning and 3D modelling



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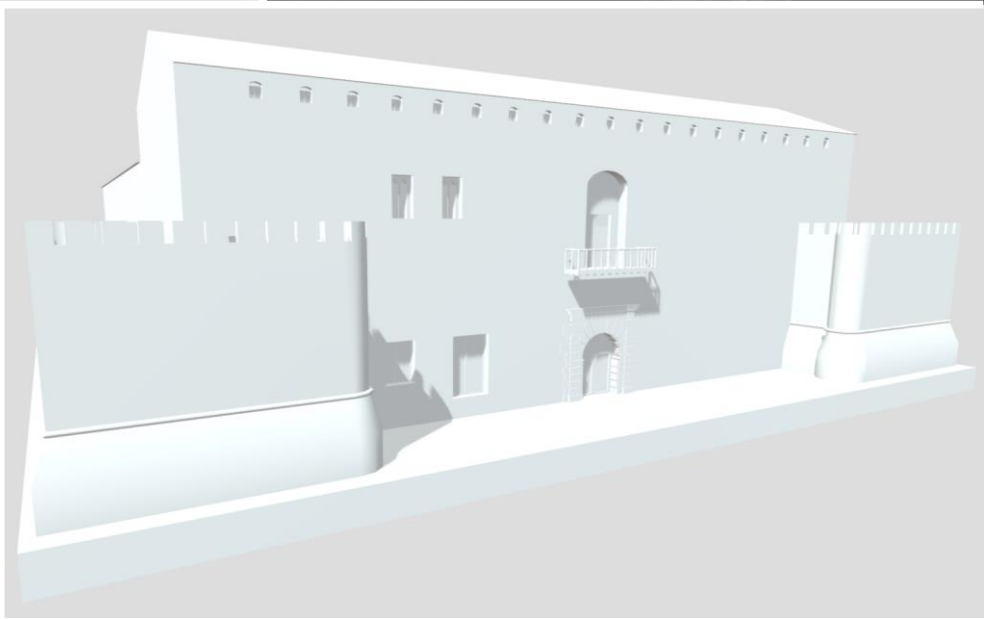

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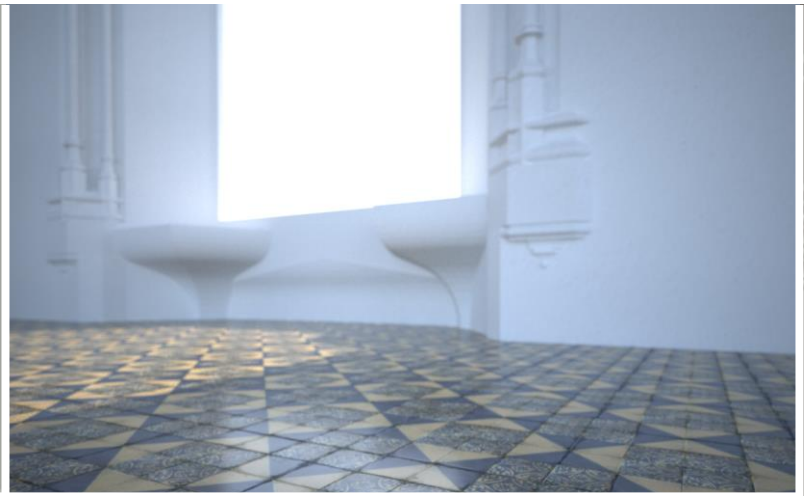

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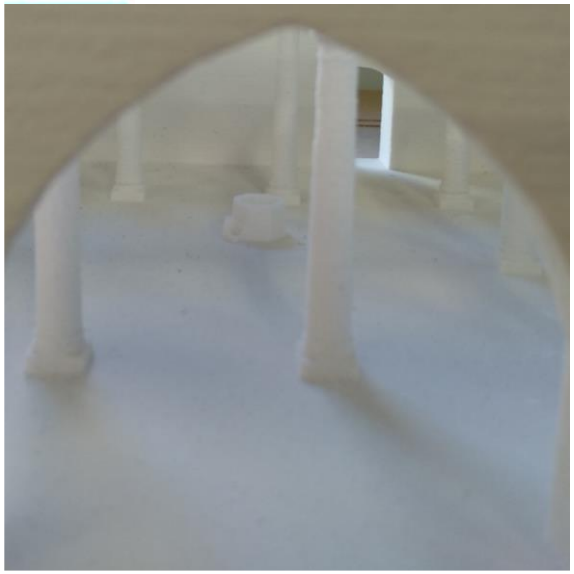
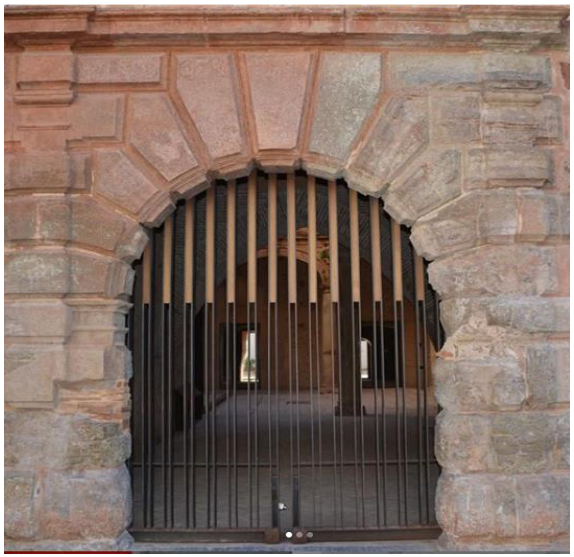
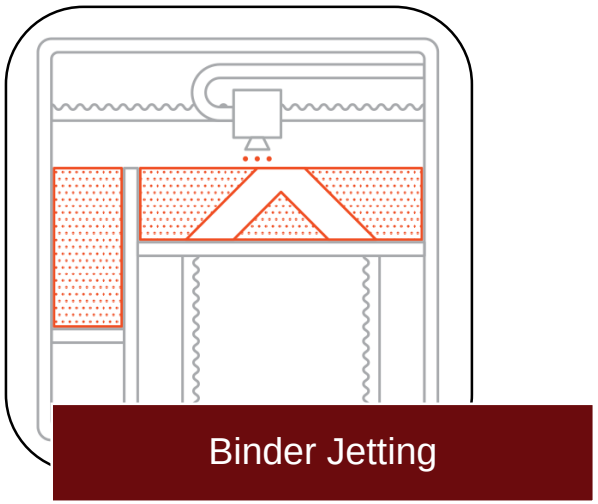



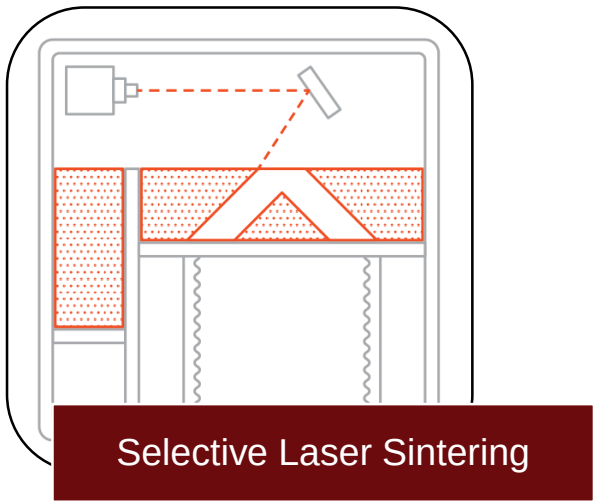
3.- Selection of 3D technologies

Process categories of the Additive Manufacturing (AM) cording to ISO/ASTM 52900

- **B**inder **J**etting **(BJ)**
- **D**irected **E**nergy **D**eposition **(DED)**
- **M**aterial **E**xtrusion **(ME)**
- **M**aterial **J**etting **(MJ)**
- **P**owder **B**ed **F**usion **(PBF)**
- **S**heet **L**amination **(SL)**
- **V**at **P**hotop**o**lymerization **(VPP)**



Binder Jetting

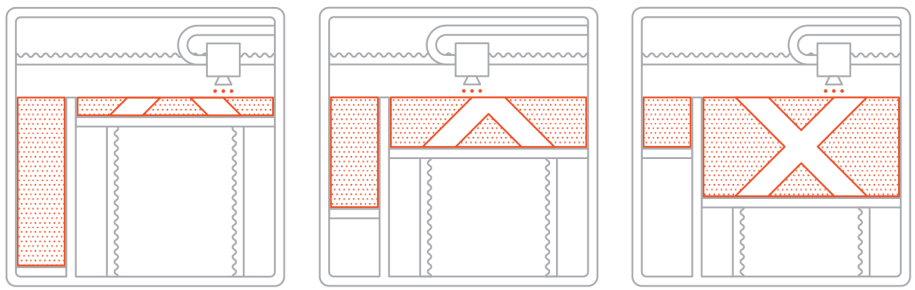


Selective Laser Sintering

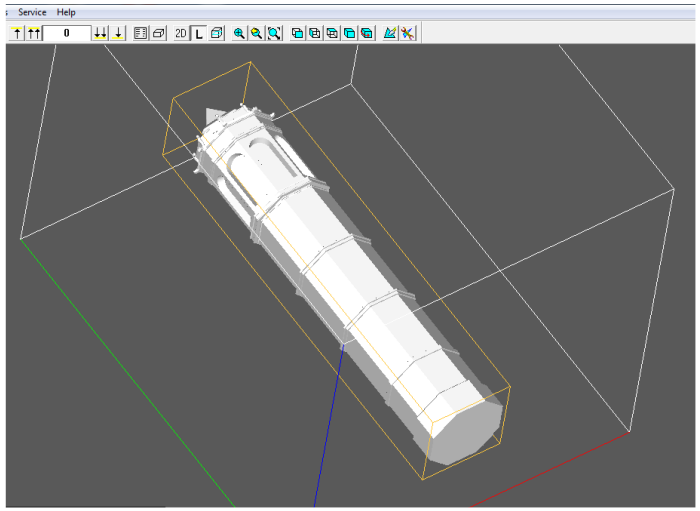
3.- Development of materials

BJ
Binder Jetting

- Binder jetting was developed at the Massachusetts Institute of Technology in the late 80s.
- Liquid binder droplets are selectively deposited by a print-head into a powder-bed to join loose powder particles in a layer-by-layer manner.



4.- Printing and prototyping tests



5.- Results

Reference			White paste coating	
			Mechanical strength (MPa)	Porosity (%)
R	1	v	2	70
		h	2	69
	2	v	2	70
		h	1.5	71
	3	v	2	68
		h	1.5	67

Reference			Porcelain stoneware	
			Mechanical strength (MPa)	Porosity (%)
G	1	v	4	68
		h	3	67
	2	v	11	50
		h	8	51
	3	v	12	49
		h	6	61

Orientation	Infiltration material	Reduction of open porosity(%)
H	Porcelain stoneware	10,2
	SILRES	6,4
V	Porcelain stoneware	11,1
	SILRES	4,8

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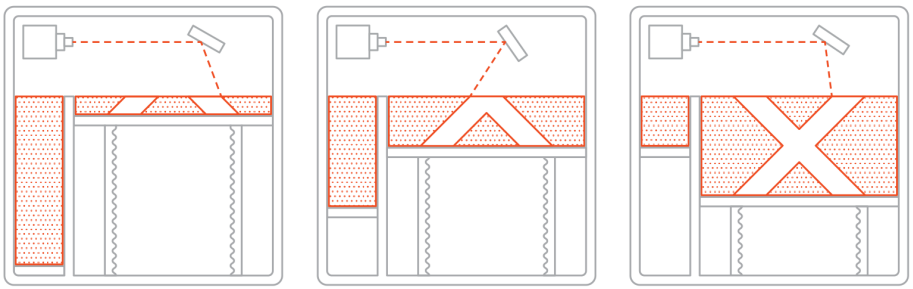
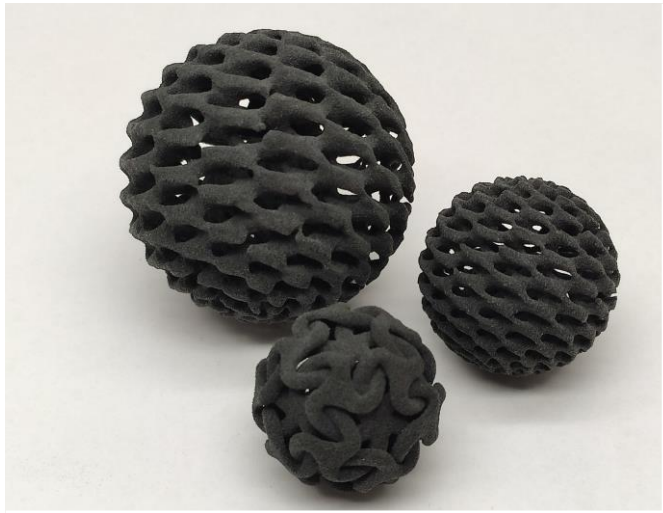
3.- Development of materials

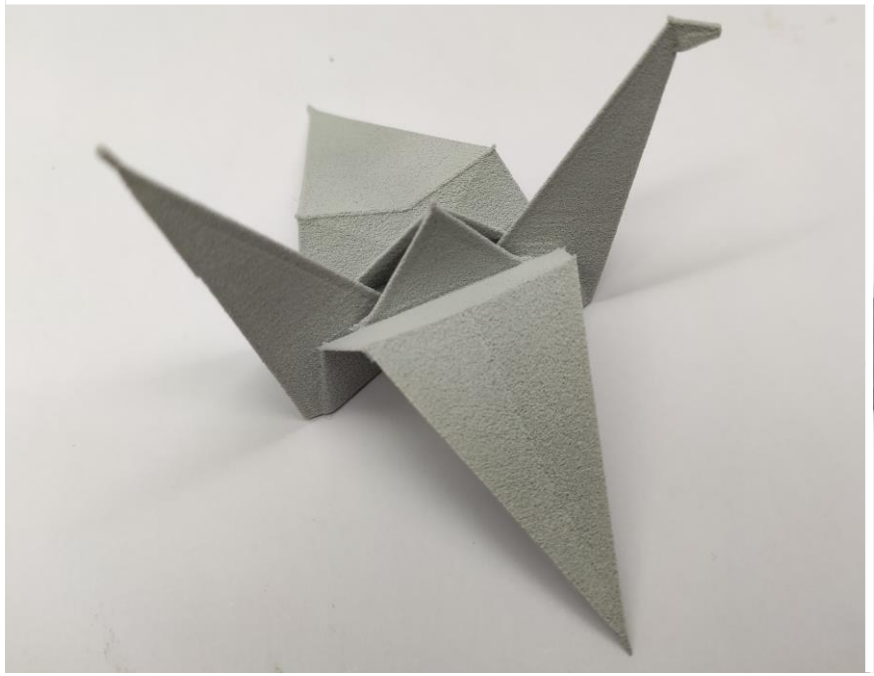
SLS

Selective Laser Sintering

- Developed by Deckard in 1987.
- A high-energy laser beam fuses powder granules directly into complex 3D net shape components in a layer-by-layer manner.



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Future work

- Continue the improvement on the superficial finish and mechanical properties of the BJ material.
- Validate results of the SLS material with ceramic charge.
- Broaden the file library of the Valencian architectural heritage.
- Creation of a public web.

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THANK YOU FOR YOUR ATTENTION

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