XI JORNADA DE JÓVENES INVESTIGADORES DEL I3A

# NOVEL FABRICATION TECHNIQUE TO CONFINE HYDROGELS WITH DIFFERENT PATTERNS INSIDE MICROFLUIDIC DEVICES WITHOUT PILLARS

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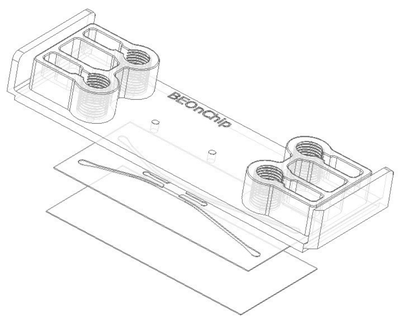
## INTRODUCTION

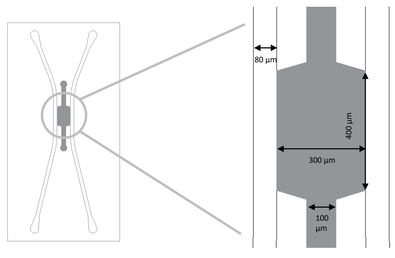
In the field of microtechnologies applied to the simulation of controlled biological environments are the so-called organ-on-a-chip, microfluidic cell culture devices. The gradient model plays an indispensable role in this technology.

We present a novel microfabrication process for pillarless microfluidic platforms which enables the creation of gradients inside them. Our approach has been to obtain the hydrogel confinement by local surface modification creating hydrophilic/hydrophobic interfaces in thermoplastic-based chips.

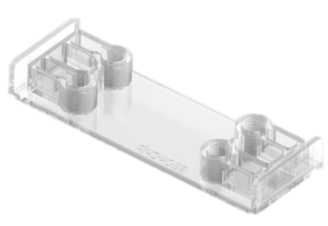
## FABRICATION TECHNIQUE



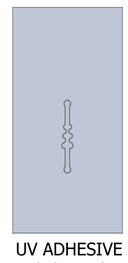

### 1. DESIGN OF THE DEVICE



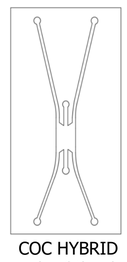

### 2. MATERIAL SELECTION AND CUTTING



COP injection piece

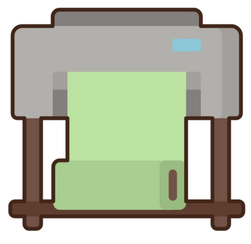


UV ADHESIVE
central channel mask

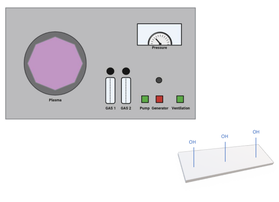


COC HYBRID
channels of the device

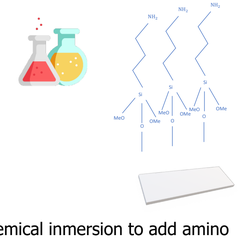
COP
base of the device



### 3. SURFACE TREATMENT




Oxygen plasma Surface activation

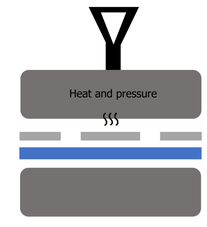


Chemical inmersion to add amino group

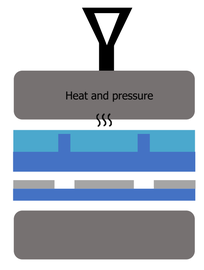
UV exposure to remove the mask

### 4. THERMOCOMPRESSION BONDING


Final assembly

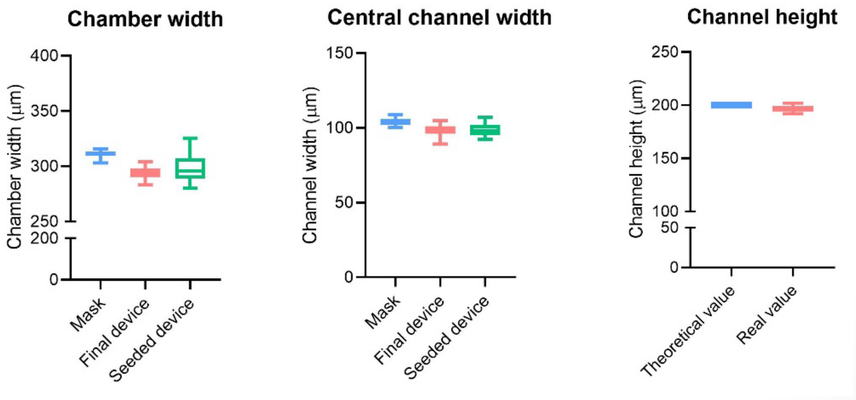



Bonding of channels and base

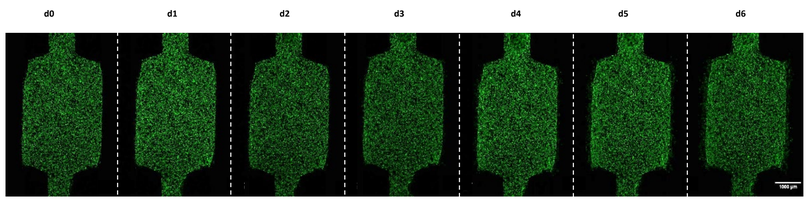


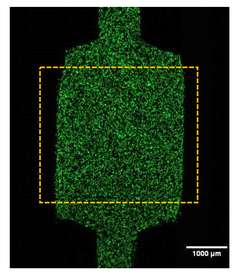

Bonding to the injection moulded part

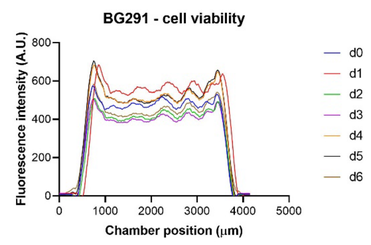
## RESULTS



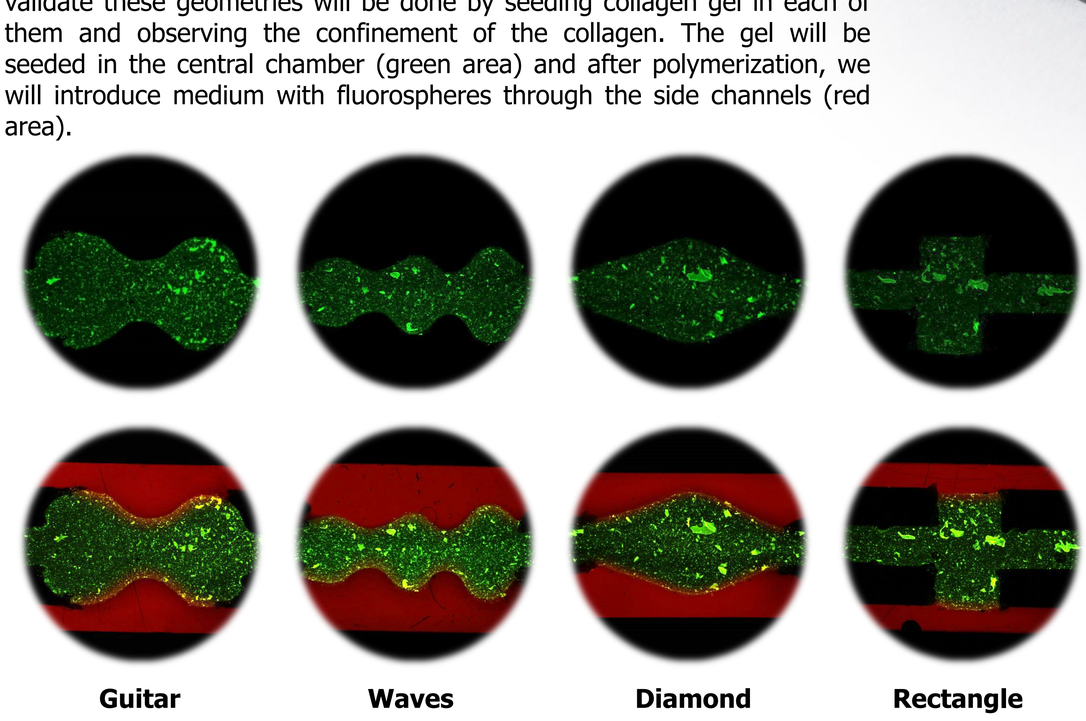

The width of the chamber, the central channel of the mask, and the final device are measured to **characterize the fabrication technique** of the device. The magnifying lens (Nikon SMZ745) and the confocal microscope (Nikon Eclipse Ti) were used to characterize the device.



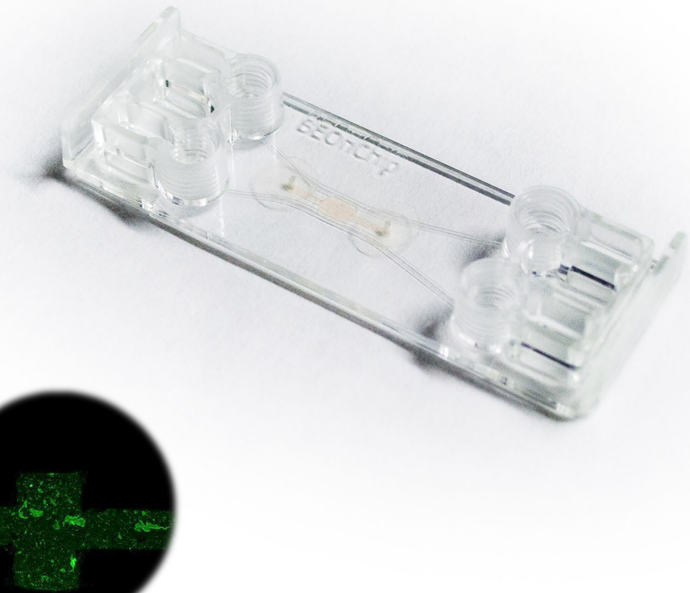



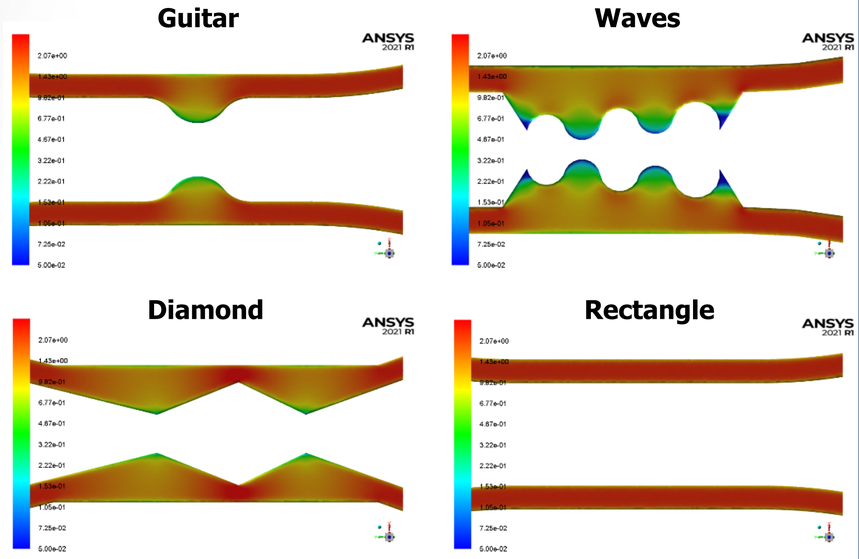

The **biological validation** consisted in a static biocompatibility test to measure cell viability over time using U-251 cell line seeded in the central chamber.




We design **4 different geometries** and, by means of these designs, the effectiveness of the surface treatment is demonstrated. The procedure to validate these geometries will be done by seeding collagen gel in each of them and observing the confinement of the collagen. The gel will be seeded in the central chamber (green area) and after polymerization, we will introduce medium with fluorospheres through the side channels (red area).




Apart from demonstrating the effectiveness of the surface treatment, the velocities, pressure and shear stresses on the walls along the different sections of each device are studied **simulating** all the different geometries.




Shear stresses along the channels in the central chamber zone.

## CONCLUSIONS

A novel fabrication technique to create pillarless microfluidic platforms with different geometries is presented. This approach can create devices within different shear stress profiles along the chip and non-altered gradients by inert materials. We have demonstrated that the fabrication process ends with biocompatible chips and works perfectly both in static and flow modes.

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