



DANIEL SILVA

## **Mechanical Engineer**

Design and Manufacturing

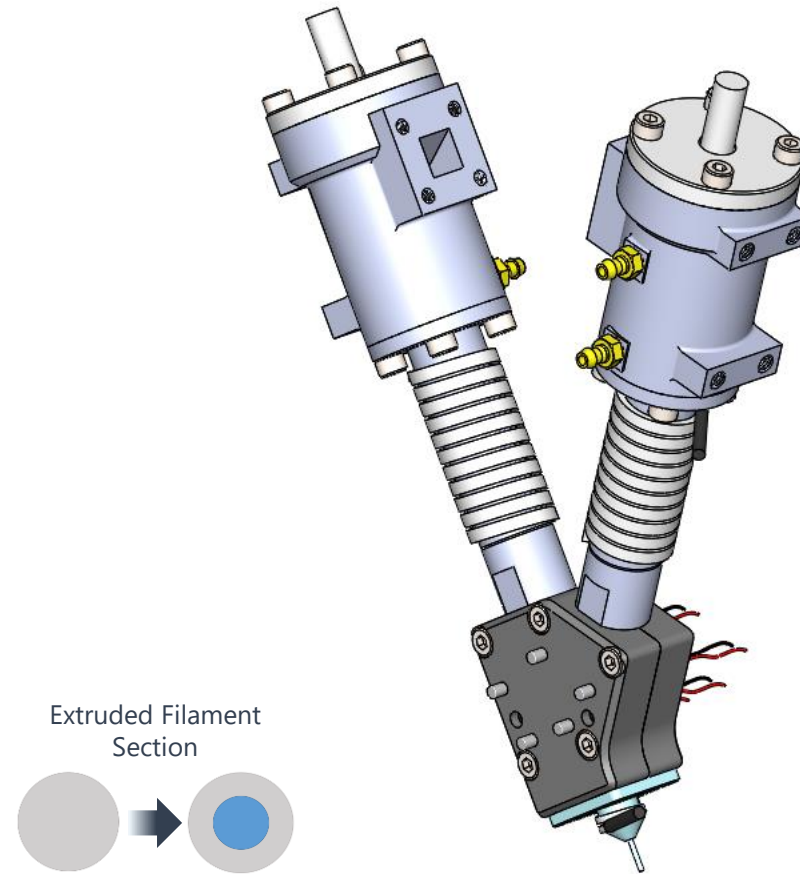
# Portfolio

Projects and prototypes



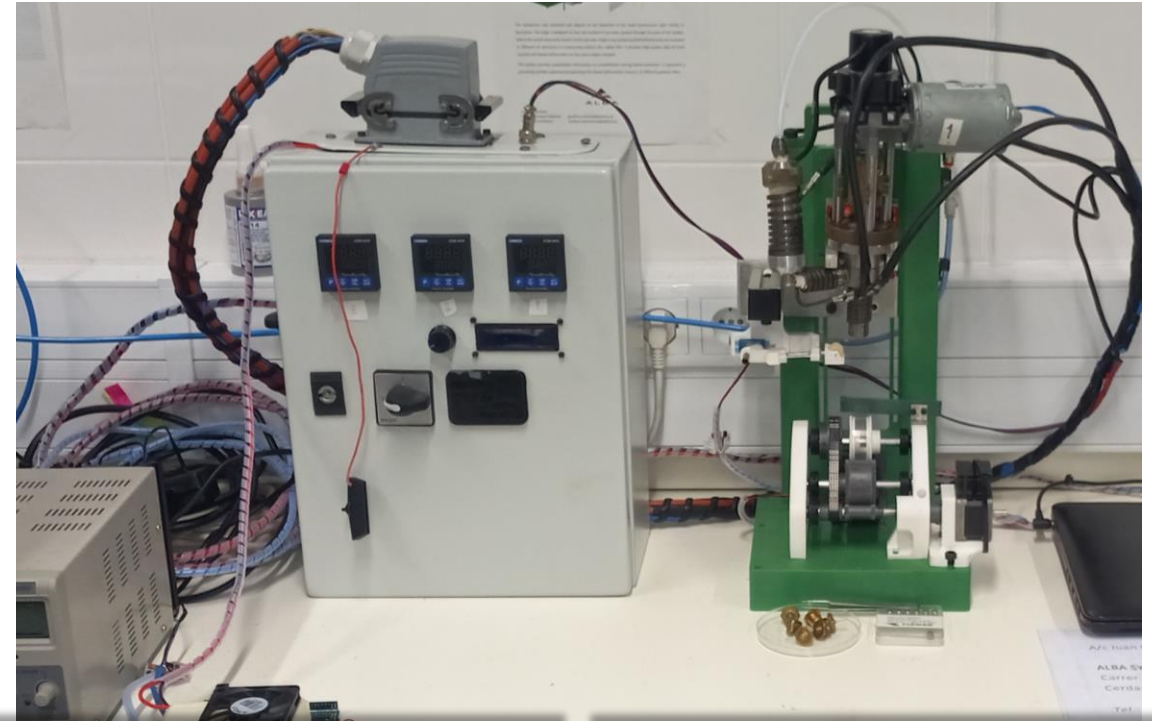
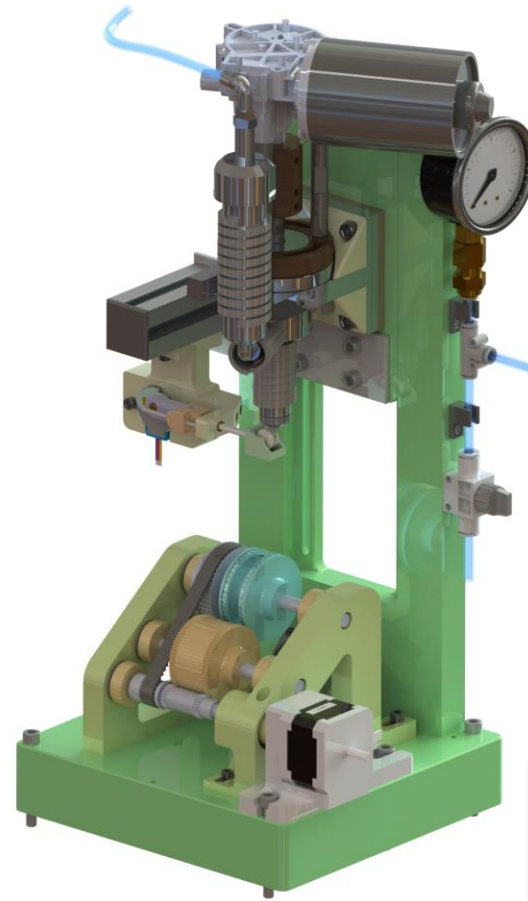
# Co-Extruder

Design for manufacturing of a Co-extruder system for 3D printing (Fused Granulate Fabrication), to extrude bimaterial filaments with different properties along the direction of deposition. The set of extruders comprises distinct heating zones, a mixing unit, and a cooled feed zone.



# Remote filament extruder

Design and manufacture of a filament extruder in order to replicate the FDM 3D printing process during the analysis of material morphology in a synchrotron beamline. This remotely controlled equipment comprises an extruder, a collector module, and a nozzle wiping mechanism



Developed using Solidworks and Arduino.



**polymers** MDPI

Article

### Changing the Paradigm—Controlling Polymer Morphology during 3D Printing Defines Properties

Daniel P. da Silva<sup>1</sup>, Joao Pinheiro<sup>1</sup>, Saba Abdulghani<sup>1</sup>, Christina Kamma Lorgner<sup>2</sup>, Juan Carlos Martinez<sup>2</sup>, Eduardo Solano<sup>2</sup>, Artur Mateus<sup>3</sup>, Paula Pascoal-Faria<sup>1</sup> and Geoffrey R. Mitchell<sup>1,\*</sup>

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**Abstract:** Direct digital manufacturing consists of a set of techniques that enable products to be fabricated directly from their digital definition, without the use of complex tooling or moulds. This manufacturing approach streamlines prototyping and small-scale production, as well as the mass customization of parts with complex designs immediately fixed before fabrication. With broad applicability, there are clearly opportunities in the field of medical devices for its use. However,

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### Property mapping of LDPE during 3D printing: evaluating morphological development with X-ray scattering

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# Remote filament extruder

## Patents

From the deployment of this apparatus, it was possible to gain insights into the development of material properties during additive manufacturing, and it is the inception of relevant outputs on this topic.

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**PATENTE NACIONAL Nº 118151**

**MÉTODO E DISPOSITIVO DE FABRICO ADITIVO POR EXTRUSÃO PARA DEFINIÇÃO DAS PROPRIEDADES DOS MATERIAIS**

Síntese do Processo

Nº do Pedido	2003801075
Data de Apresentação	09-08-2022
Data do Pedido	09-08-2022
Fase Actual	PEDIDO-ESTUDO EM CURSO
Data de Início da Fase	09-04-2024
Data de Fim Previsto	---
Situação de Taxas	NÃO HÁ RENOVACÕES A PAGAMENTO
Data de Início da Sit.	24-03-2025
Data de Fim Previsto da Sit.	10-02-2026
Taxas Pagas	4
Taxas Pendentes	0



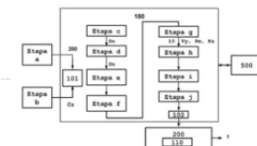
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**PATENTE NACIONAL Nº 118569**

**MÉTODO IMPLEMENTADO POR COMPUTADOR PARA O FABRICO E OTIMIZAÇÃO MORFOLÓGICA E ESTRUTURAL DE UM OBJETO COM PROPRIEDADES VARIÁVEIS ESPACIALMENTE, SISTEMA, PROGRAMA DE COMPUTADOR E MEIO DE LEITURA ASSOCIADOS**

Síntese do Processo

Nº do Pedido	2004668226
Data de Apresentação	23-03-2023
Data do Pedido	23-03-2023
Fase Actual	PATENTE CONCEDIDA
Data de Início da Fase	08-01-2025



**Changing the design paradigm – 3D Printing on molecular texture in plastics**

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MIT Portugal  
2022 Annual Conference

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**Introduction**


Additive manufacturing is now more than a prototyping set of technologies, it is a viable manufacturing methodology that allows mass customization and the achievement of complex shapes [1]. The focus of the developments in **3D printing** is often on geometric and dimensional reproduction of the digital form of the product. In polymer processing technologies, the manufacturing parameters affect the mechanical properties of the final products, and this is also well established in 3D printing [2]. It is known that, when polymers with high molecular weight are extruded through a die with an appropriate length-to-diameter ratio, a preferred orientation in the melt can be induced. When the temperature decreases, a highly anisotropic crystalline morphology is formed. Consequently, this morphology unravels different mechanical properties in comparison with the morphology formed from a quiescent melt. In accordance with [3], this can result in a significant increase in the elastic modulus.

The present work shows some results of **morphology analysis** with in situ X-ray scattering, employing a customized 3d printer adapted to an X-ray scattering beamline at the ALBA Synchrotron, correlating the processing parameters with the preferred molecular orientation.

The focus of this project is to explore the scope for depositing materials with different properties by controlling the structure and morphology of the polymers, more than replicating shapes. With new degrees of freedom, the team is working in order to apply this methodology, in non-planar layers of deposited material, in order to obtain new designs of material along a given designed model.

**Morphology Analysis**

As previously mentioned, the team used a customized 3D printer to evaluate the morphology control of semi-crystalline polymers during extrusion. This model, mounted on the NCD-SWEET beamline platform, as observed in **Figure 1**, allows the deposition of material onto a rotating platform, resorting to a single extruder with a dual channel



# Wrist rehabilitation device

Conception, design, and manufacture of a device for a gamified therapy solution. The device aims to help the patients recover from wrist injuries using its modularity to practice hand movements with several degrees of freedom and intensity.



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## PATENTE NACIONAL Nº 111118

### DISPOSITIVO DE CONTROLO DE PUNHO PARA TREINO E REABILITAÇÃO FUNCIONAL

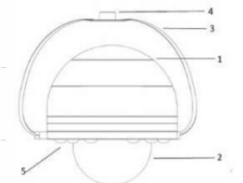
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Data do Pedido	30-08-2018

Fase Actual	PATENTE CONCEDIDA
Data de Início da Fase	05-01-2022
Data de Fim Previsto	30-08-2038

Situação de Taxas	NÃO HÁ RENOVAÇÕES A PAGAMENTO
Data de Início da Sit.	07-03-2022
Data de Fim Previsto da Sit.	01-03-2023
Taxas Pagas	5
Taxas Devidas	0

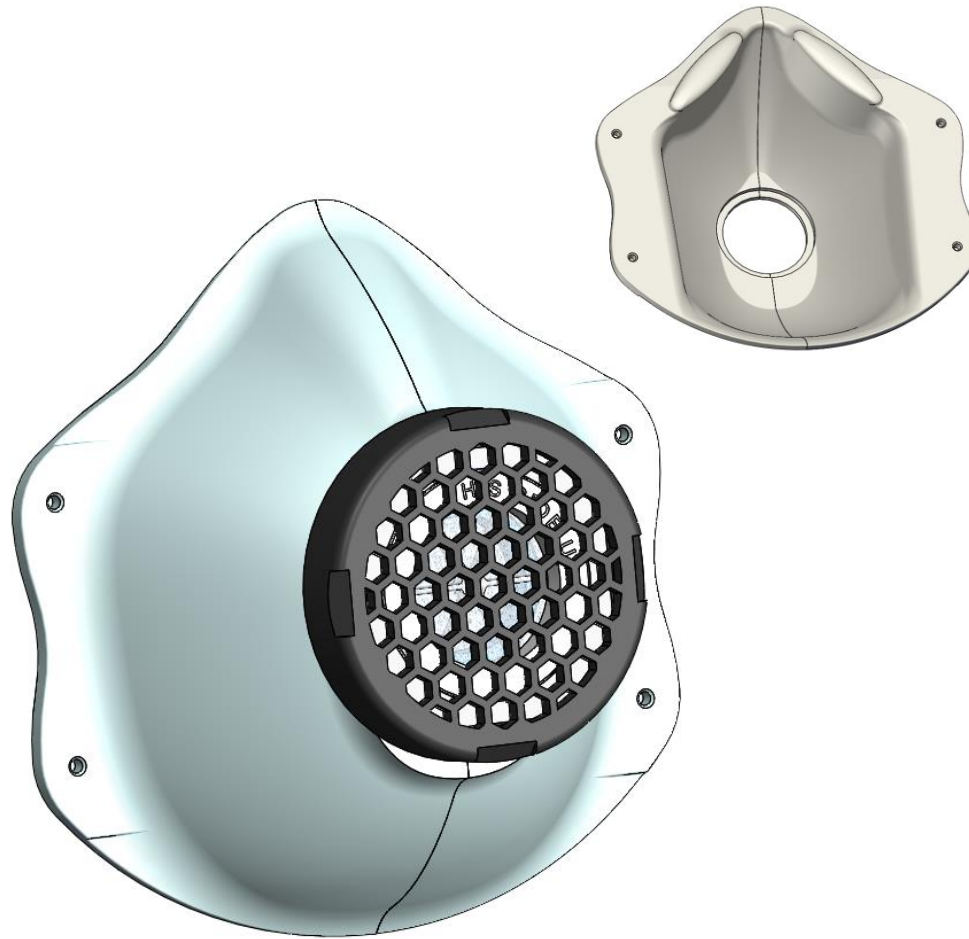
BPI 1ª Publicação	02-03-2020
Data do Despacho	30-12-2021
BPI do Despacho	05-01-2022
Data de Início de Vigência	30-08-2018



# COVID Mask

Conception, design, and manufacture of a mask with removable filters.

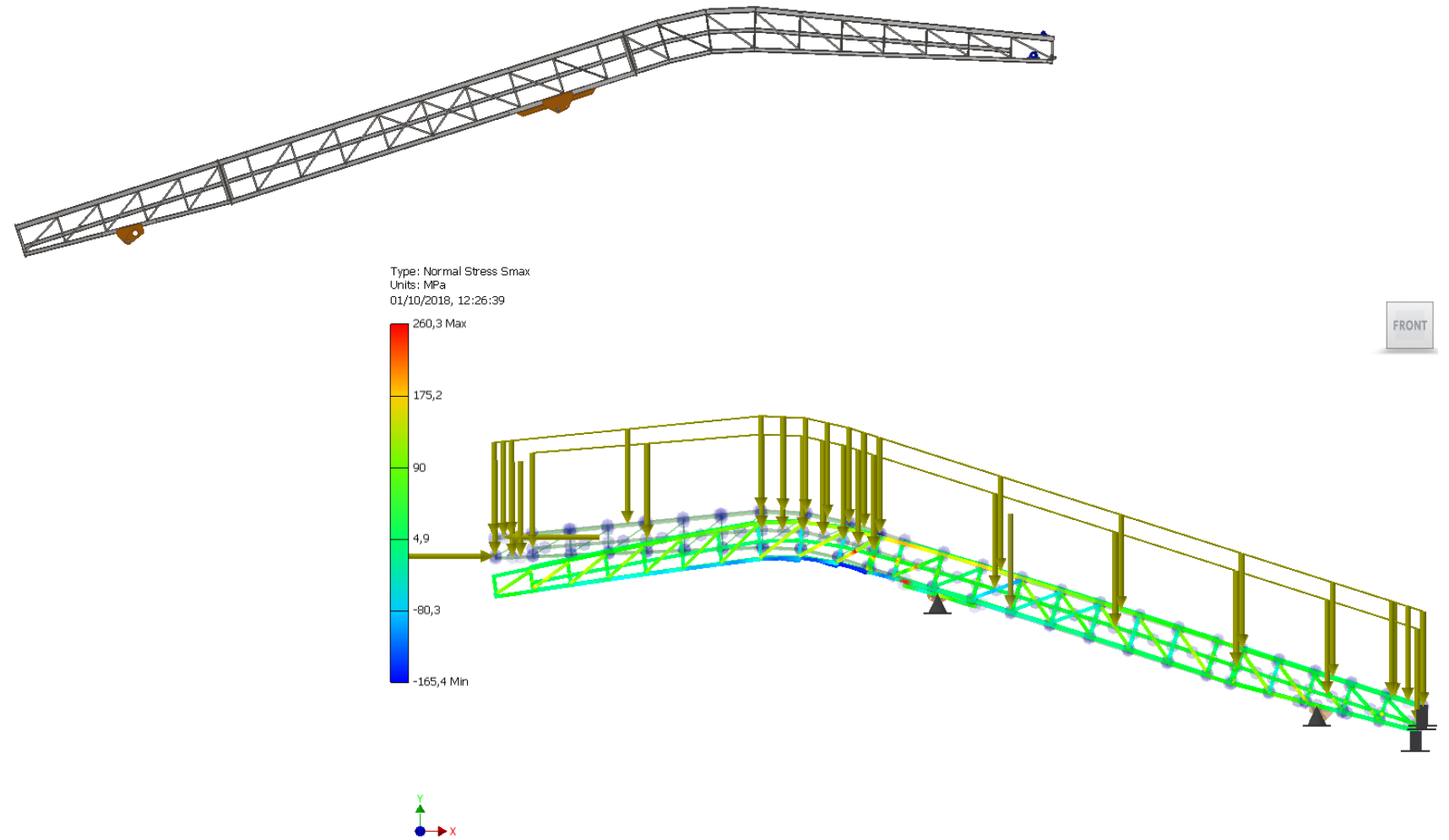
This work was developed during the first stages of the SARS-CoV-2 pandemic, in search of a more sustainable solution and new high-performance protective layers with smaller pores.



# Truss structure simulation

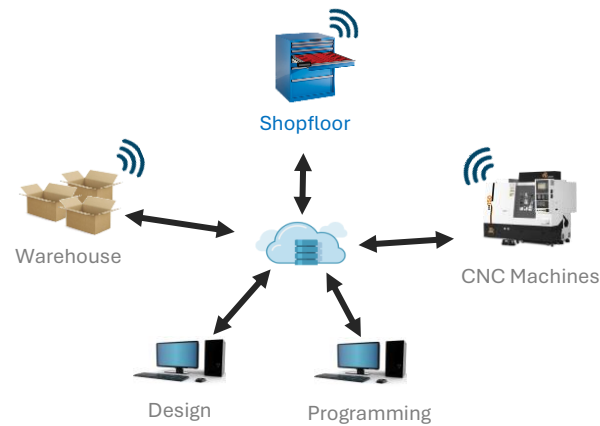
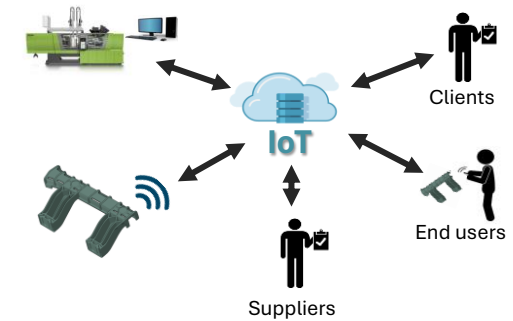
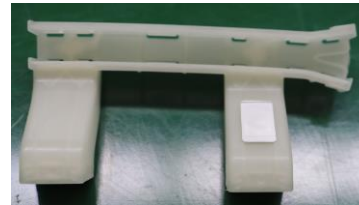
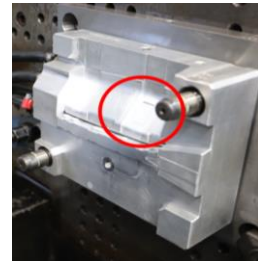
Design of a truss structure for a large load handling machine project.

This project counted on several iterations of mechanical simulation with static and dynamic loads, according to the Eurocode standards (mainly EN 1990 and EN 1991).



# IoT projects

Conception, design, and integration of hardware for the implementation of the *internet of things*, namely in injection moulded parts and milling & cutting tools.

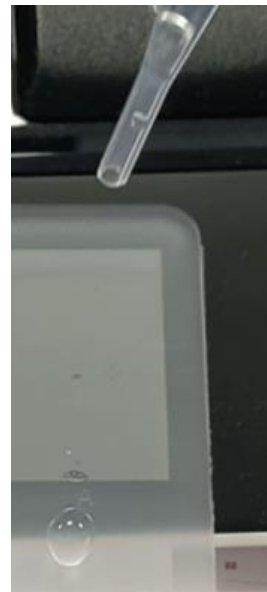


Demonstration software developed using VB in Visual Studio and MIT App Inventor for Android.

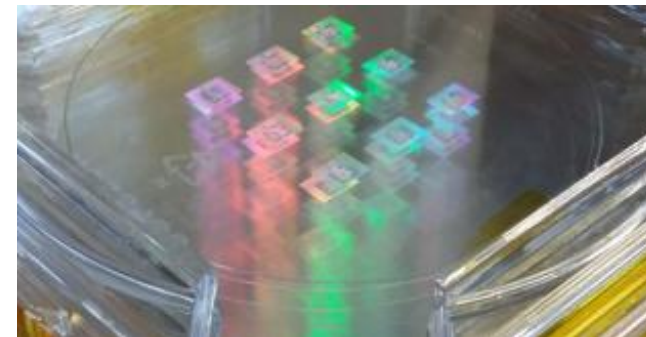
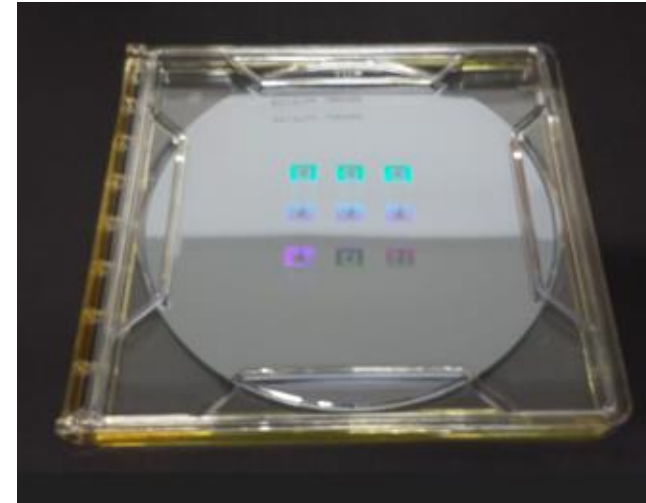


# Other works

Pattern design and liaising of micro and nanostructuring services for the replication of superhydrophobic surfaces and diffractive optically variable devices for anticounterfeiting solutions.



Hydrophobicity



Optical Diffraction

# Additional experience

## Equipment and tools



### 3D printers

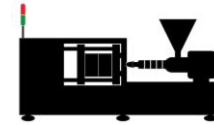
- Creatbot F430
- Flashforge Guider IIs
- Flashforger Creator 3
- Flashforge Inventor
- Creality Ender 3
- Anycubic Photon

### Technologies

- FDM/FFF
- FGF
- DLP

### Materials

PLA, ABS, PETG,  
TPU, PP, PE, PBS.



### Injection moulding machines

- BOY 22A
- Engel VICTORY 200-45T
- Ferromatik Elektra Evolution 110-300
- Billion 200T

### Technologies

- Conventional
- Co-injection
- IML – *In-mould labelling*

### Materials

Stock and reinforced fossil  
and bio-based materials.



### Others

- Universal Testing Machine:  
Instron 4505 (Tension and  
Compression)



- 3D Scanner: Artec Leo



# 3D Printing at home

Replacement garage remote control case



Rotating shaft of a lemon squeezer



Bachelorette party pins



Rotating shaft of a vegetable grater





DANIEL SILVA

**Mechanical Engineer**  
Design and Manufacturing



Thank you



Nº 79936, Ordem dos  
Engenheiros - Região Centro  
(Portuguese Engineers Association)

Quality means doing it right when  
no one is looking

