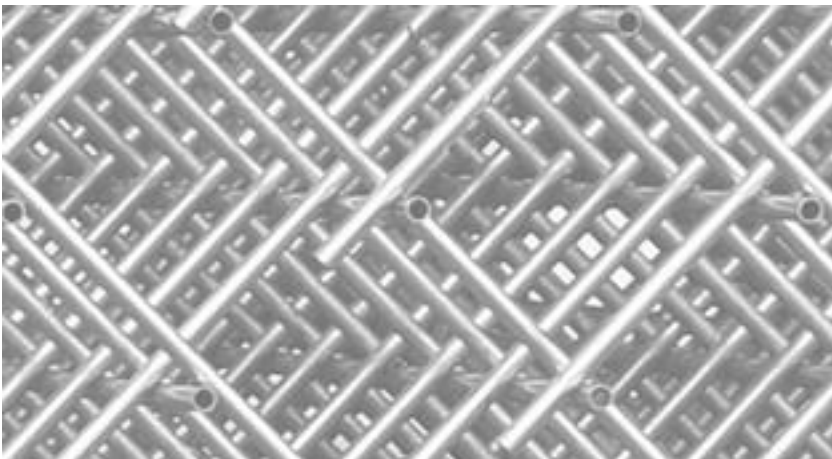
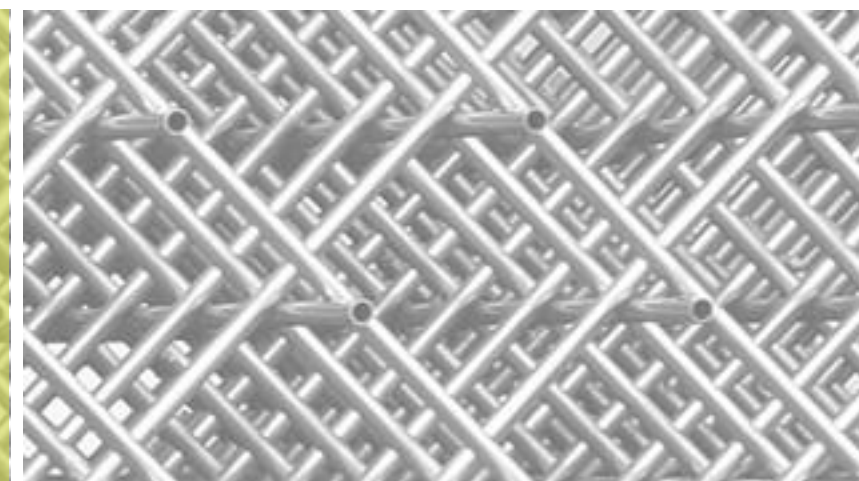
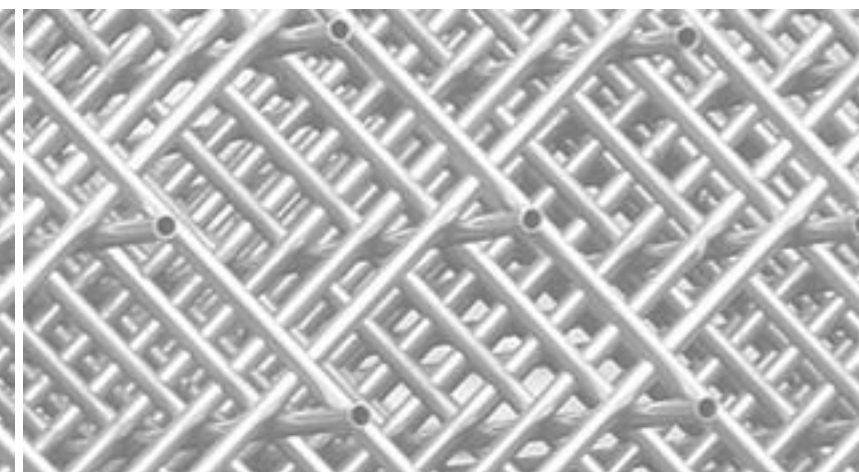
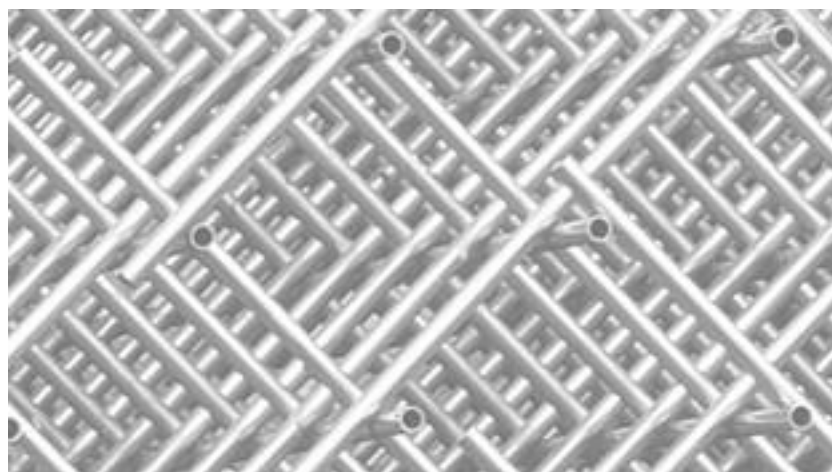


# Lightme

11 February 2021

## Open Call event

Gianluigi DE SIMONE | Iris srl



# Outline

1

## The Borealis PL

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- *Present solution and capacity of the line*

2

## Upgrades incoming/completed

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- *Control system*
- *Handling of nanomaterials*

# The company

## Plasma for Environment

**IRIS** develops plasma technology applications to liquid/solid waste treatment. **IRIS** patent pending solutions improve technical and economic efficiency of small scale - on site treatments enabling no waste / zero carbon footprint processes.



## Additive Manufacturing

**IRIS** is involved in the development of the next generation Additive Manufacturing machines. **IRIS** specialises on process definition and process characterisation using performance indicators such as production time reduction, cost savings and energy & resource efficiency



## Laser processing design

**IRIS** develops smart self adaptive solutions for the efficient exploitation of laser processes: cutting, welding, direct metal deposition. The focus is on process set up, characterization and validation vs. performance target and green labelling.

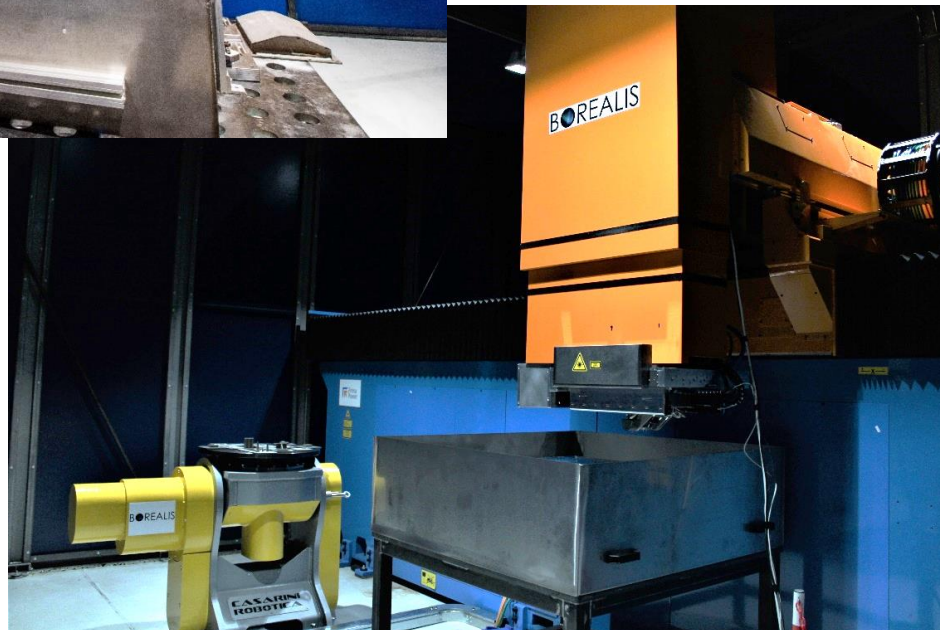
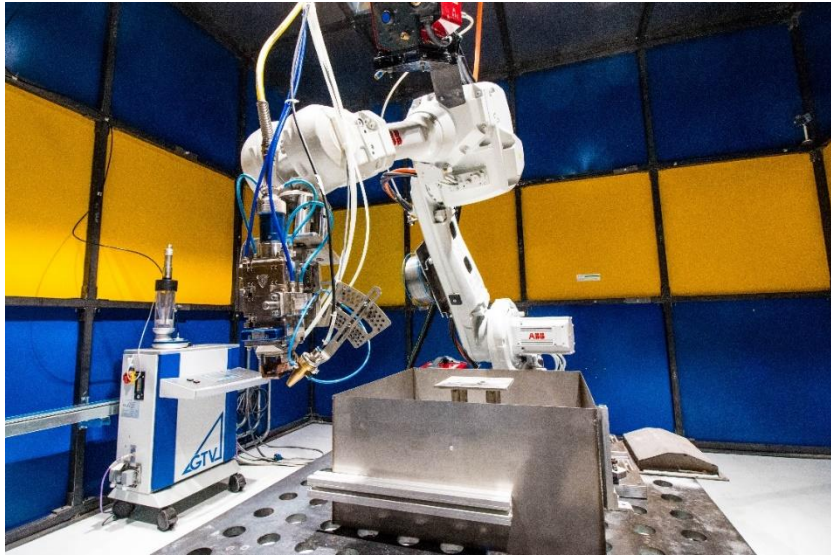


## Technology Transfer

**IRIS** supports partner companies in developing applications based on the use of laser and plasma technologies through all project phases: idea definition, fund raising, benchmark, R&D programs, engineering, partners search, exploitation of research results.

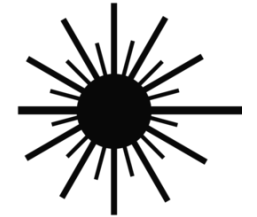


# Present solution



## Direct Energy Deposition process

5 kW fiber laser



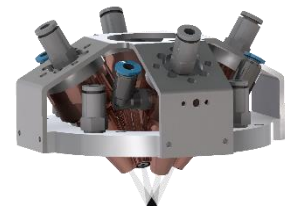
## Redundant deposition head

New concept of nozzle

Efficient usage of carrier gas

Independent regulation of

each nozzle



## Multi Degrees of Freedom

6 DoF on the anthropomorphic robot

2 DoF on the Roto-tilt table



# Advantages

## Multi material approach

Steel 316L

Titanium alloy  $Ti_6Al_4V$

Aluminum alloys A357

AlSi<sub>10</sub>Mg

Ti+TiC **new!!!**

**Working volume** up to 1000x2000x1000 mm

**Production rate** Up to 200 cm<sup>3</sup>/h

4 **nozzles** mounted on the deposition head, thus ensuring the chance to create new alloys or composites directly on site by adjusting separately the material flow rate for each nozzle.

**flexibility** of materials and process, being able to use an anthropomorphic robot or a Cartesian movement.





02  
Upgrade  
Incoming



Lighttime

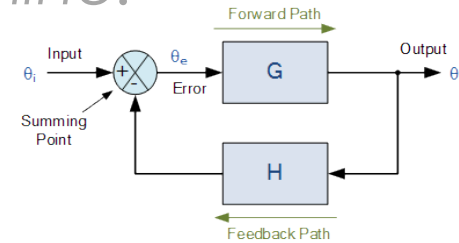
# Upgrades

the innovations and upgrades of the pilot line:

1. monitoring and control of the process
2. processing in an inert atmosphere

## Goals:

- maintain a stable process by avoiding any heat accumulation
- Avoiding the presence of defects, such as pore and cracks




## How?

- Development of **process control**
- Optimization of **process equipment**

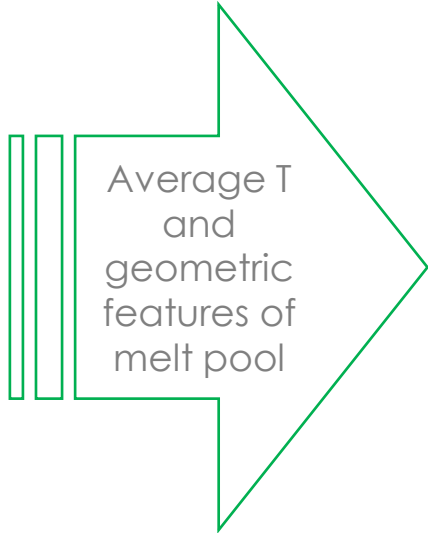


# Monitoring & Control system



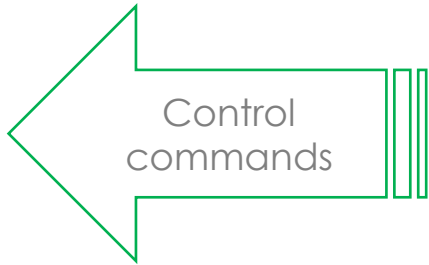
**MPM Analysis** 


Acquisition of video-images and running of video-analysis algorithms



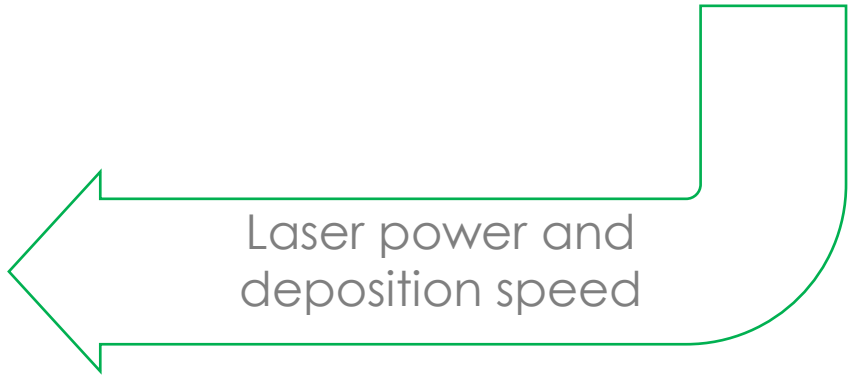
**MPM feedback** 

Acquisition of melt pool features and running of control logic



**MPM Communication** 

Real-time control of robot to tune process parameters



# PL Upgrade

**Process equipment**, specifically:

- *Deposition head 2.1*
- *Glovebox 1.0*

**Why?**

- *to obtain an easy tuning and facilitate the centering of the focus of the powders with that of the laser.*
- *avoid oxygen contamination of Ti + TiC*

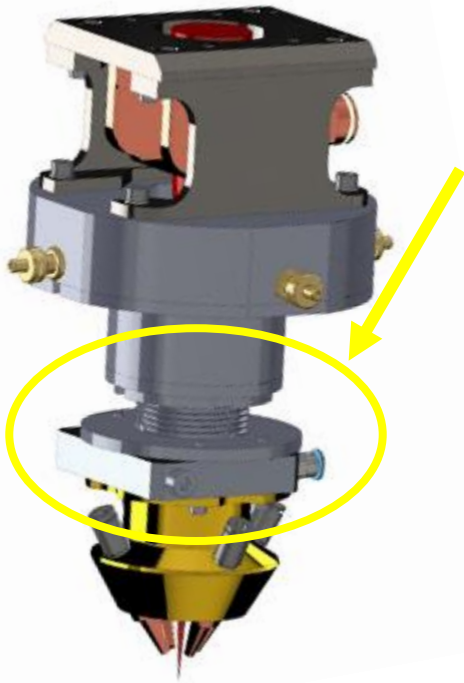


***excellent quality of the specimens!!!***

# New Deposition head 2.1

## Main features:

- 4 interchangeable nozzles;
- Possibility of adjusting the focus of the powders;
- Possibility of centering the flow of powders with respect to the laser focus.
- Coaxial gas shielding cover



## **Further upgrade:**

re-engineering of the most stressed components



The new deposition head allows

- easy and quick setup;
- greater precision in the realization of the clad.

# Glovebox 1.0

Previous:



Identification of needs and design:

## Conclusion and next steps:

### Process parameters window:

- Laser power: from 1.3 to 2 (kW)
- Deposition speed: from 40 to 60 (mm/s)
- Powders flow: from 0.055 to 0.150 (g/s)
- Carrier gas flow: 2 (l/min)
- Shielding gas flow: from 10 to 30 (l/min)

TO DO: greater control of the air content in the deposition area, through the construction of an Argon controlled working chamber, because a preliminary test shows that this can reduce the amount of pores in the clad.



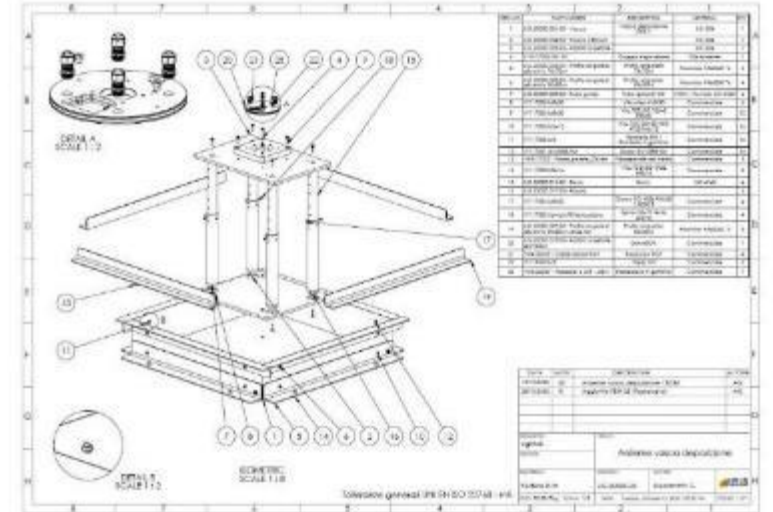
Before

After



### TECHNICAL SPECIFICATION: Inert Deposition Bag

Features	Description	Required	Wished
Main features	Environment controlled by Direct Metal Deposition laser process by injecting with Argon gas.		
geometry	<ul style="list-style-type: none"> <li>The entire system must rest on a square base with a 1020 mm side</li> <li>Height up at least 1500 mm</li> </ul>	X	
Hooking system	<ul style="list-style-type: none"> <li>The bag must be hooked above the arm of the ABB anthropomorphic robot (see Annex 1)</li> <li>On the lower side, on the other hand, it must be possible to hook onto the sheet metal box in which the deposition and collection of dust takes place (see Annex 2)</li> <li>Modification of the deposition box to adapt to the hooking system (by IRIS, currently it is a square with a side of 800 mm, but can be enlarged up to 1000 mm)</li> </ul>	X	X
Safety	<ul style="list-style-type: none"> <li>The DED deposition process uses a high energy laser (up to 5 kW), which leads to the melting of metal powders. For this, the chamber must be made of material resistant to this stress.</li> </ul>	X	
Inert environment	<ul style="list-style-type: none"> <li>Argon inlet from below, air outlet from above</li> <li>Control of oxygen level and humidity</li> <li>Closing system that prevents the entry of air from the outside</li> <li>Closing system that allows any air to escape</li> </ul>	X	X
Handling of samples	<ul style="list-style-type: none"> <li>We must be able to handle the component without the need to open and close the bag to prevent the entry of air and must inert again.</li> </ul>	X	
Process control	<ul style="list-style-type: none"> <li>Transparent surface for visual monitoring of the process</li> </ul>		X
Further request	<ul style="list-style-type: none"> <li>Delivery in September</li> </ul>	X	

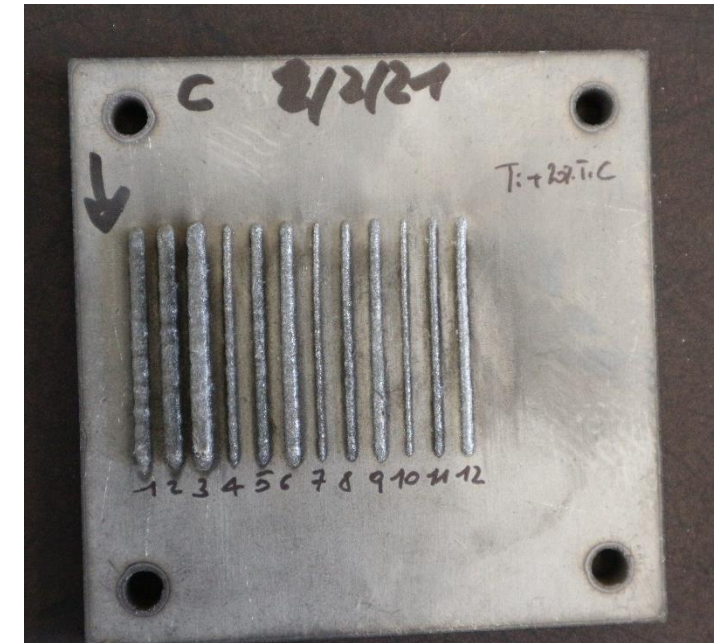
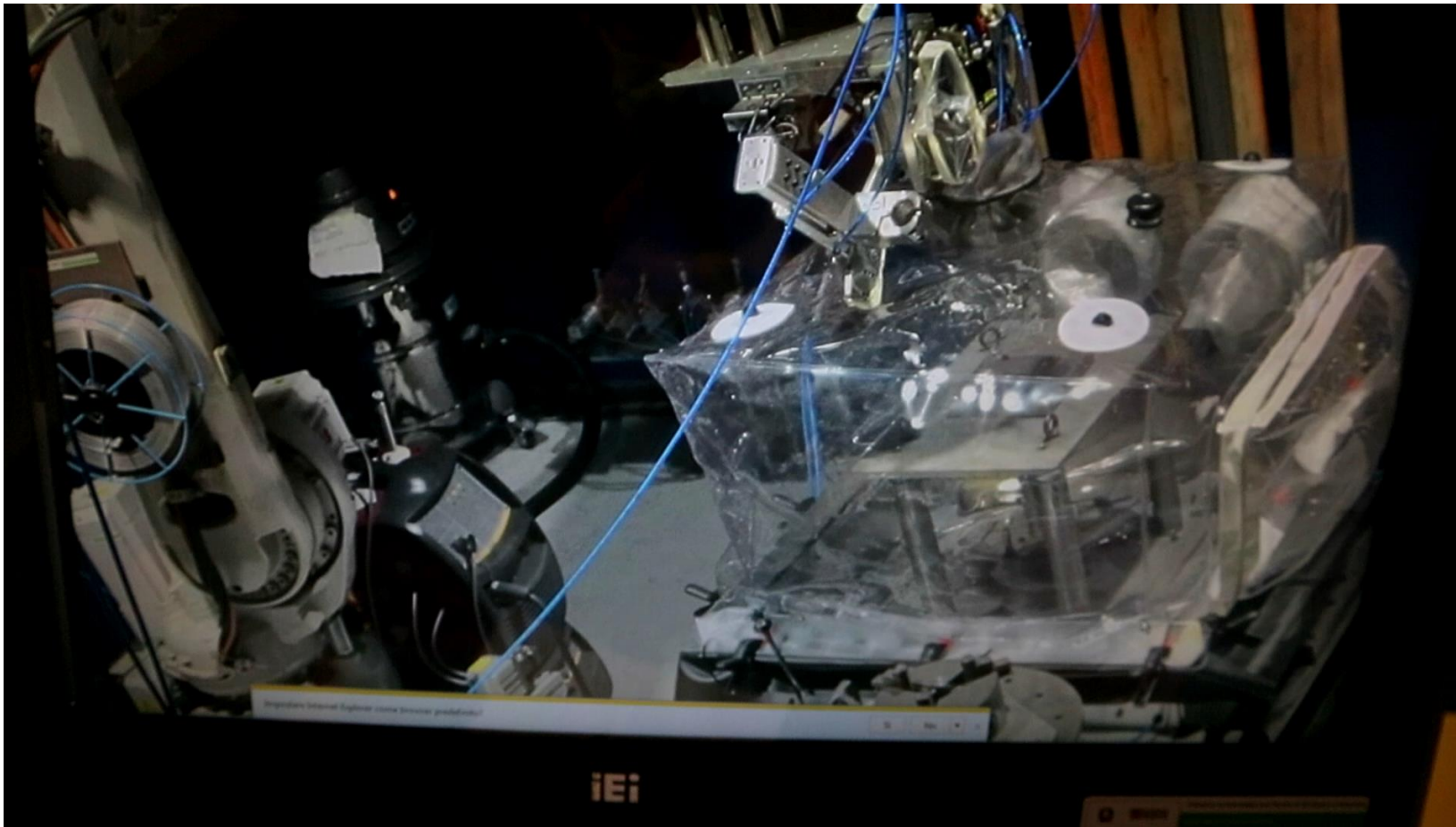


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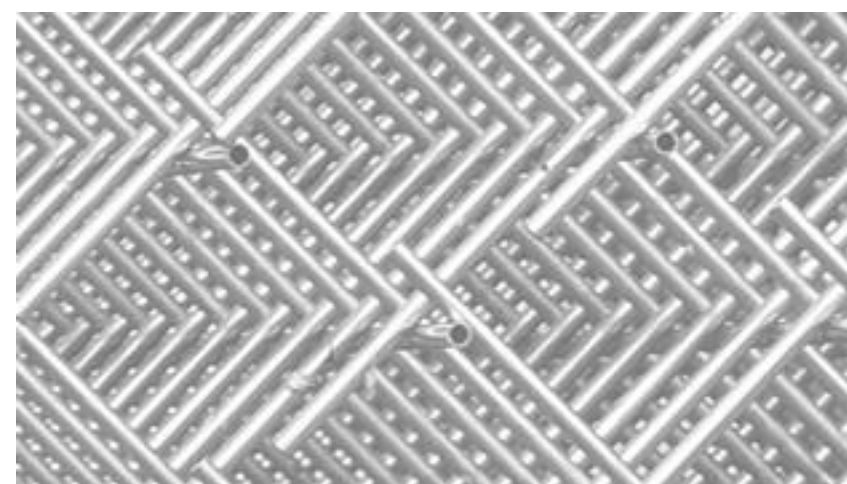
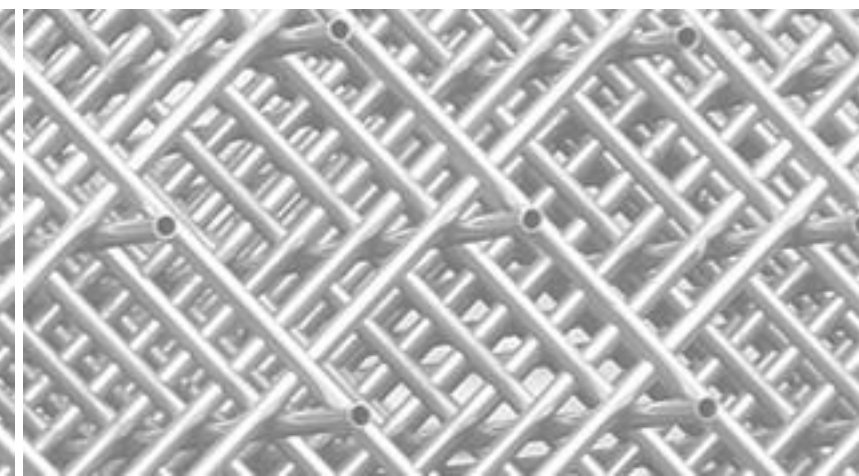
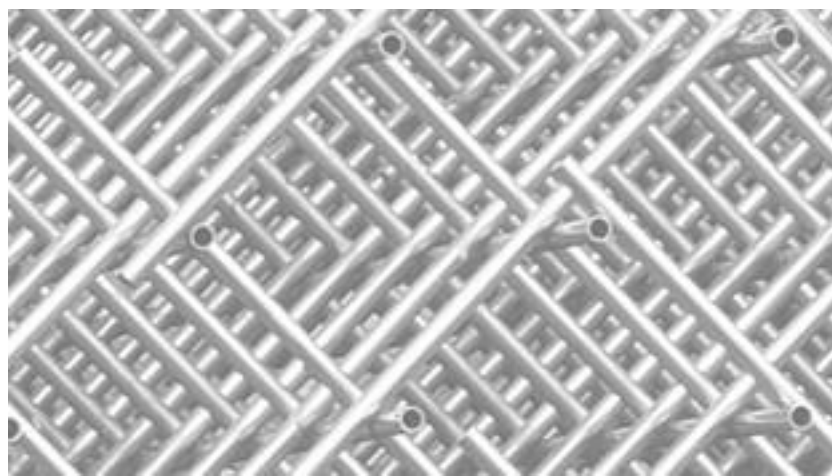
# Glovebox 1.0

→ Process: how it works

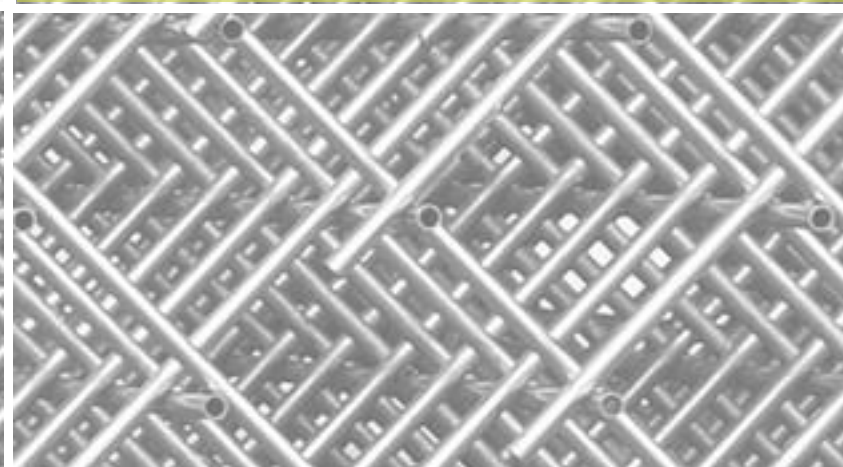
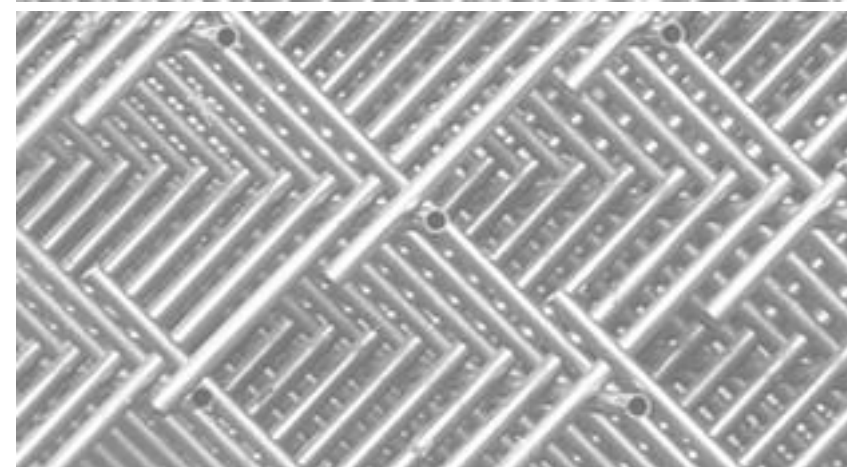




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*Thank you for your attention*



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European  
Commission

Horizon 2020  
European Union funding  
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