

# AIMEN INTRODUCTION



***Building a sustainable future***

2024

# 01 AIMEN Introduction

We are a multi-sector **Innovation and Technology Centre** that develops **R&D&I activities** and provides technological services to the industry in the fields of

**MATERIALS, ADVANCED MANUFACTURING PROCESSES, DIGITALISATION & SUSTAINABILITY**

Headcount: **300** (50% in R&D&i)

**250**

R&D&i Projects  
In the last 10 years



**+550**

Customers  
Annual average  
In the last 5 years



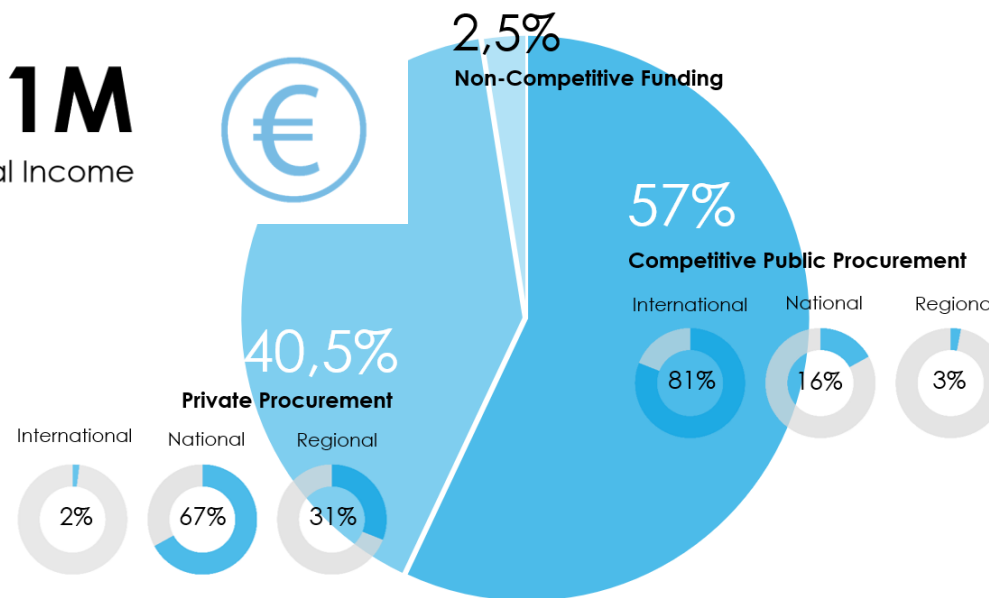
**2.303**

Industrial Services  
In the last 10 years



**>21M**

Annual Income



**23%**  
Mobility



**22%**  
Aerospace



**22%**  
Industry



**12%**  
Energy



**9%**  
Chemist



**12%**  
Others

# AIMEN Introduction

## R&D&i Division

## Industrial Division

Circular Economy	Advanced Composites	Additive Manufacturing	Laser Technologies	Welding and Joining	Simulation and Digital Twin	Technological Training
Sustainable Manufacturing	Functional Materials	Sensors	Smart Manufacturing	Inspection and NDT	Advanced Engineering	Materials Characterization

2 facilities

In O Porriño

9.500 m<sup>2</sup>

of scientific-technological infrastructures






# R&D Capacities and expertise

*Building a sustainable future*

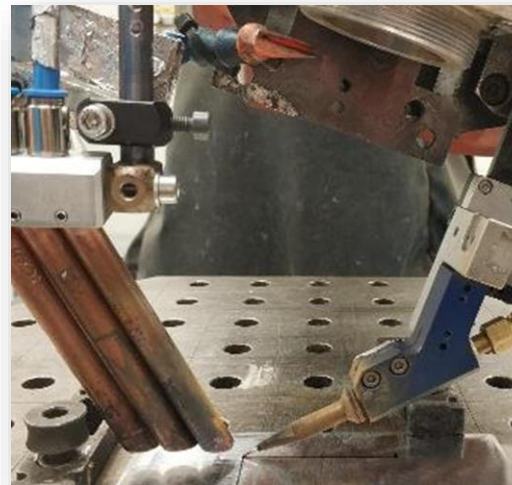
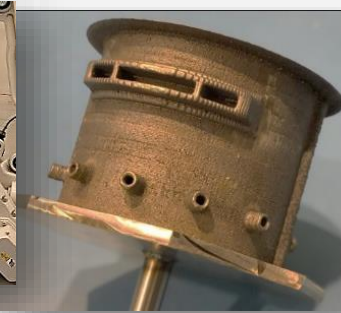
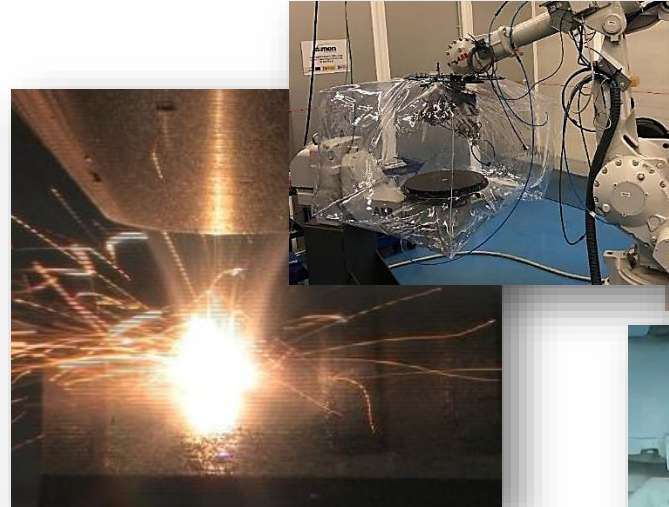


## LARGE METAL PARTS AM

Laser or in combination with other technologies, for direct production of features, parts or products, by means of cladding, wire melting and directed material deposition. Includes material issues, quality (geometrical and functional), equipment (optical heads), programming (3D geometry, reconstruction).

**LASER METAL DEPOSITION (LMD):** Powder feedstock (< 1 kg /h, Surface finishing: 30-200  $\mu\text{m}$ ), Wire feedstock (0.5 – 2 kg /h, Surface finishing: 30-200  $\mu\text{m}$ ). **Materials:** Steel, tool steel and Stainless Steel, Aluminum, Inconel, Bronze and Titanium

**WIRE ARC ADDITIVE MANUFACTURING (WAAM):** 1-5 kg/h, Surface finishing: 200-500  $\mu\text{m}$ , Limited complexity, Large dimension > 500mm. **Materials:** steel, stainless steel, aluminium, inconel, bronze





# POLYMERS AND COMPOSITES AM

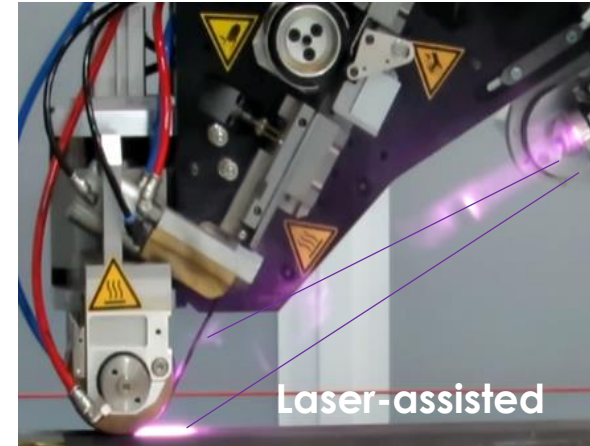
# ADDITIVE MANUFACTURING

## AUTOMATED FIBRE PLACEMENT, AFP

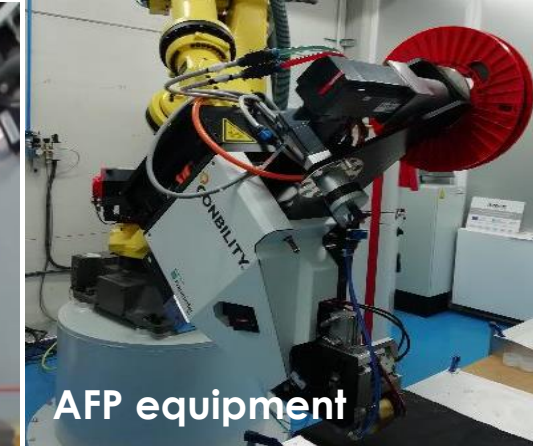
Robotized, 6kw diode laser & IR heating, thermoset, thermoplastic & dry fiber materials

Commercial materials but also on-development materials

Laser control, process monitoring, in-line quality control



Laser-assisted



AFP equipment

## FUSED FILAMENT FABRICACION, FFF

FFF robotized pilot cell (CCF 3D printing). 7m x 4m

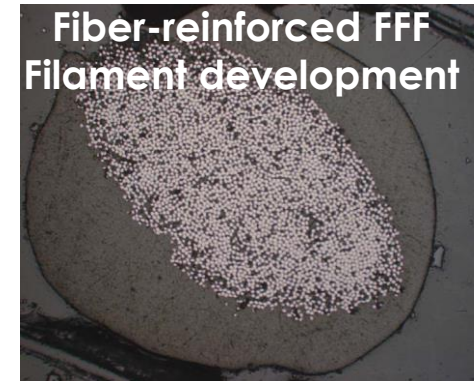
Desktop printers (up to A2 and 450°C)

Materials development, Continuous Fiber Filament & Pellets

Laser control, process monitoring, quality control



Fiber-reinforced FFF  
Filament development



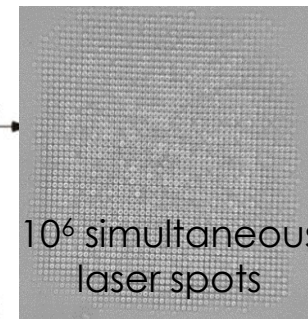
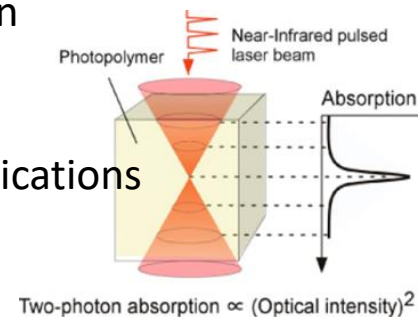
## MICRO ADDITIVE OF PHOTOCURABLE RESINS

Multiphoton polymerization, beam forming parallelization

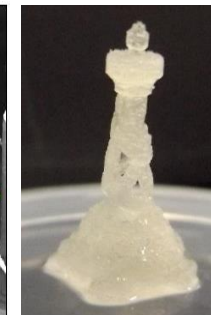
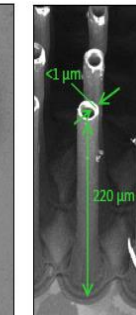
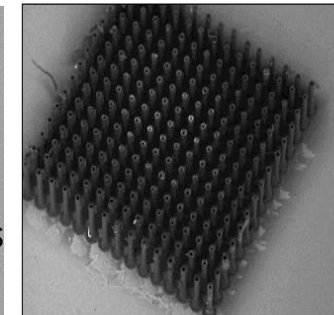
Laser induced forward transfer (lift)

Large area and high-speed processing

Optostructures at scales 100 nm to 10 microns, with applications in lighting, displays, sensing, etc.



10<sup>6</sup> simultaneous  
laser spots



3D MICROSTRUCTURES





# ADVANCED MANUFACTURING OF COMPOSITES

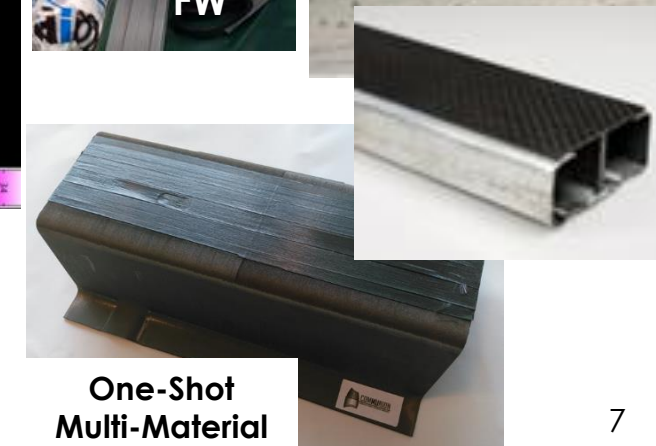
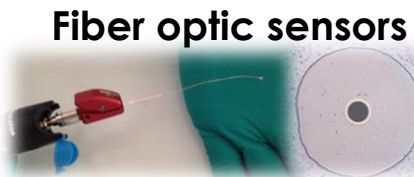
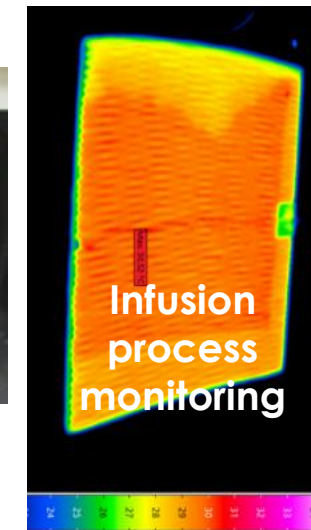
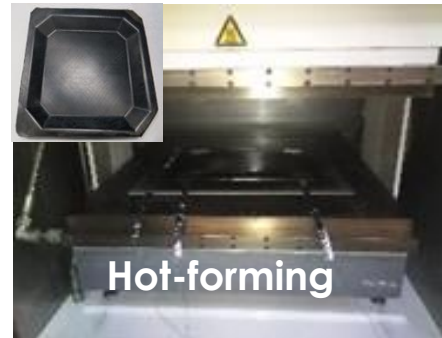
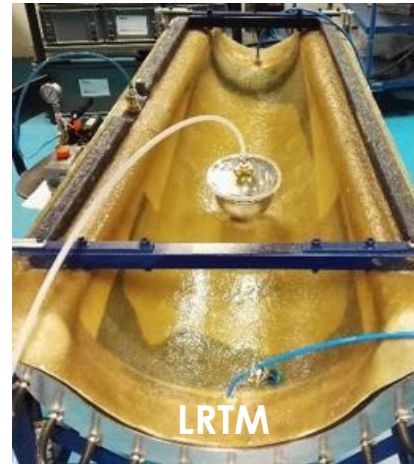
**THERMOPLASTIC COMPOSITES:** injection and over-molding, 3D press forming (up to 400 °C, including PEEK, PPS, PEI, etc.).

**OUT-OF-AUTOCCLAVE THERMOSET COMPOSITE PROCESSING:** VBI, LRI, LRTM, RTM, filament winding, VBO curing, hot-press curing (prepregs), wet compression.

**COMPOSITE WELDING:** Development of welding heads, continuous welding equipment and thermoplastic welding process optimization (ultrasounds, induction, resistive, laser).

**PROCESS MONITORING** - resin flow and cure evolution using DC-Dielectric sensors, fiber optics sensors (FOS), Electrochemical-Impedance Spectroscopy and electrical resistance sensors.

**MULTIMATERIAL COMPOSITE-METAL:** Metal (Ti, Al, Steel) – thermosetting & thermoplastic polymer/composites manufactured by One-shot Processes and using surface treatments (laser, plasma, abrasive, others) and adhesives.



## HIGH POWER PROCESSES AND APPLICATIONS

**ADVANCED JOINING TECHNOLOGIES**, Laser and hybrid welding processes. Highly reflective alloys: aluminum alloys (series 1XXX, 2XXX, 5XXX, 6XXX, 7XXX), Copper alloys. Improvements on productivity, depth, material range, etc... in laser welding and cutting

**SURFACE TECHNOLOGIES**, cladding, heat treatment over many different metallic materials.

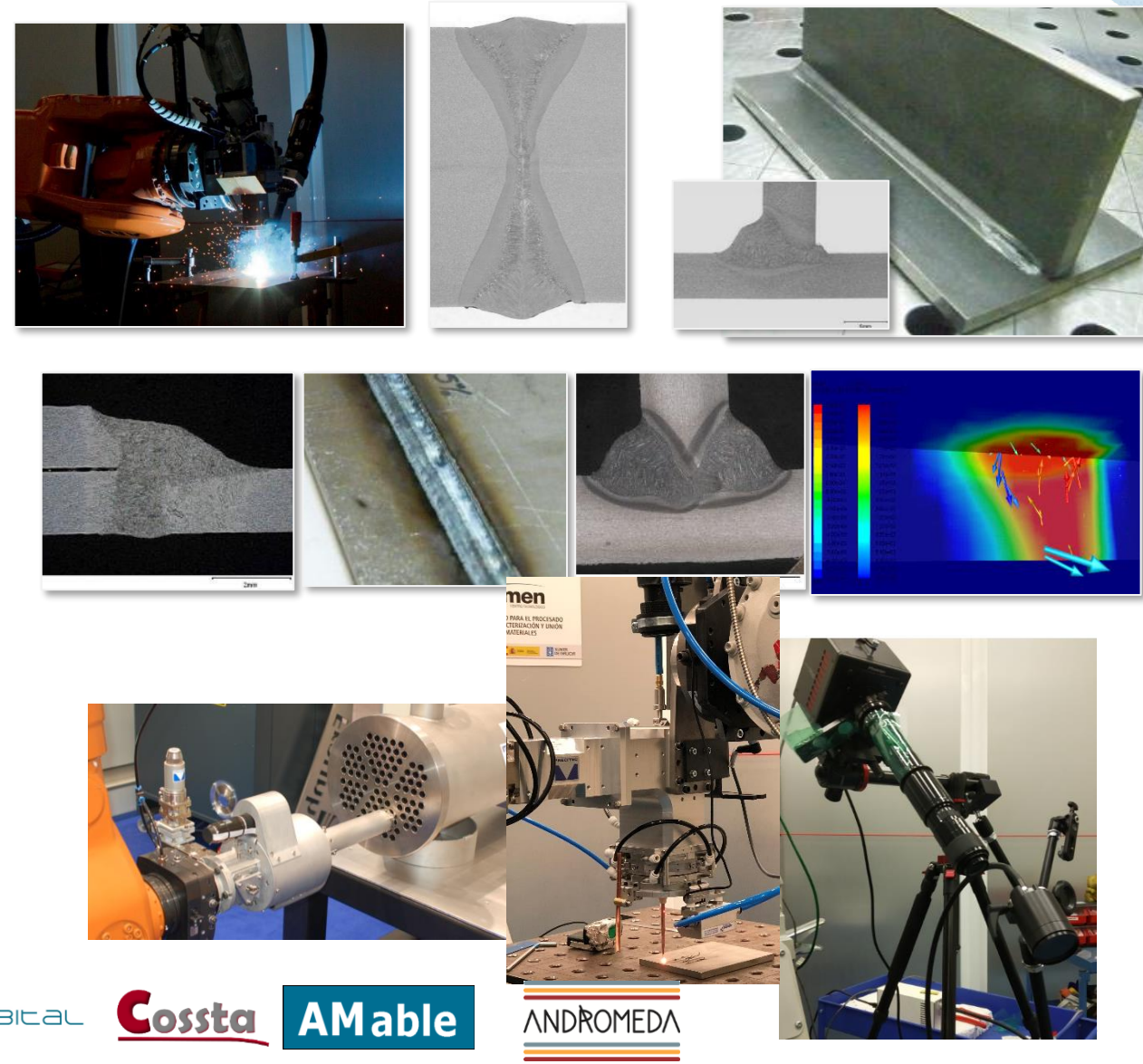
**LASER ASSISTED PROCESSES**, cladding, heat treatment over many different metallic materials.

## SYSTEM TECHNOLOGY FOR LASER PROCESSING

**OPTICAL SYSTEM SOLUTIONS**, Optical system solutions for laser material processing (application-tailored and hybridisation)

**IN-LINE MONITORING SOLUTIONS** Optical solutions for process monitoring and inspection of materials processed by laser

**DIGITISATION** and system integration of laser-based Manufacturing





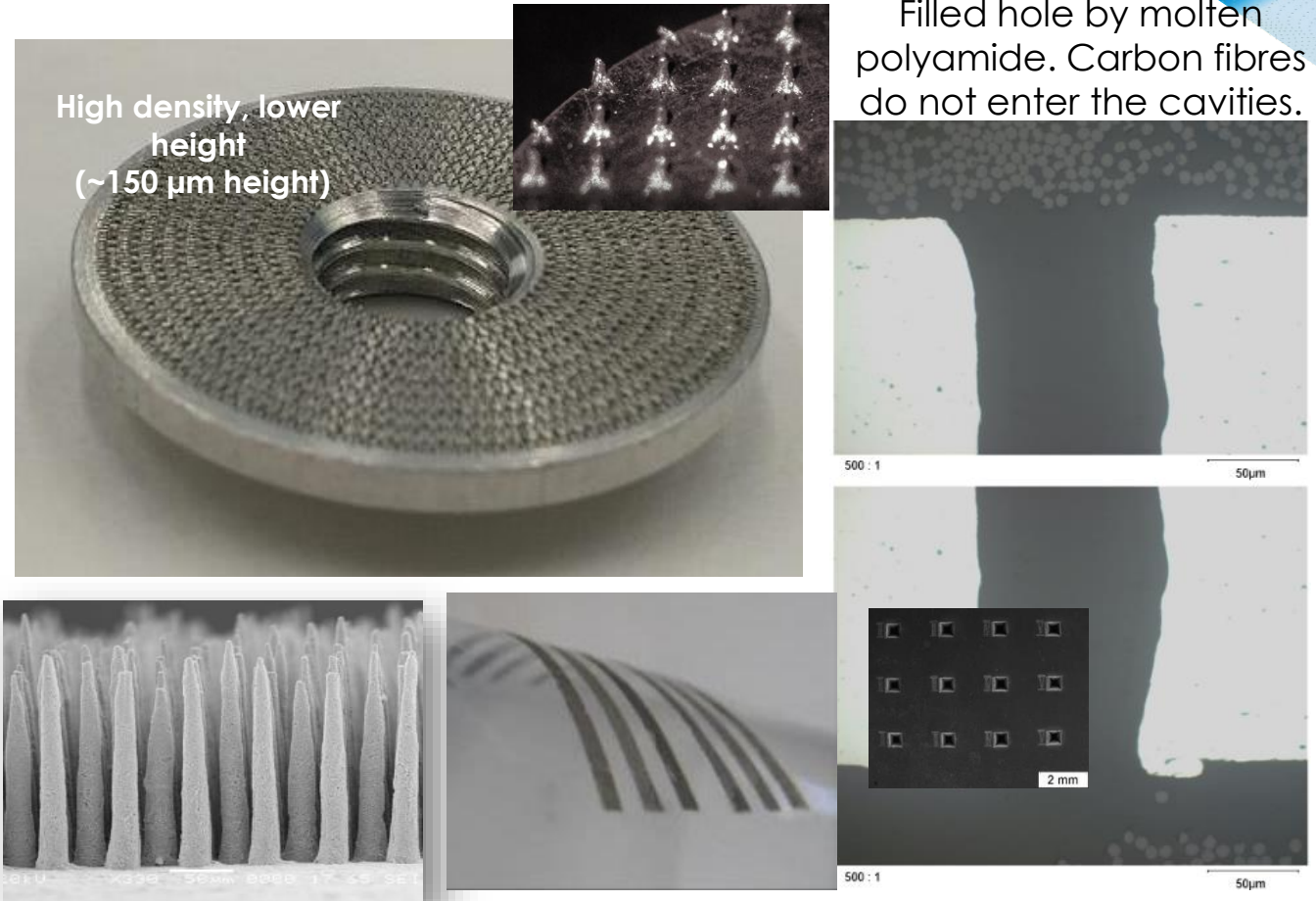
## HIGH PRECISION MANUFACTURING

**MICROMACHINING**, drilling, high precision welding & cutting, surface texturing. Direct laser patterning by melting, ablating or combination of both regimes

Metals, polymers, textiles, composites, ceramics, polymers, ceramics etc.

## SURFACE MODIFICATION AND FUNCTIONALIZATION

Metallization, enhancement of heat transfer and conductivity, improvement of tribology properties, optical properties, adhesion improvement, wettability control, biocompatible and antibacterial surfaces. Contaminants and demoulding agents removal, Chemical modifications, Tailored roughness. Painting/gluing improvement through superficial laser treatment.



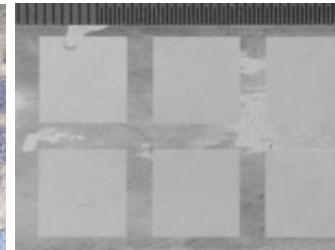
Textile



Composite



Titanium



Magnesium

# ADVANCED MATERIALS

**ELECTRIC GENERATING SYSTEMS:** Wet-spun piezoelectric composite fibers, battery performance and lifetime (battery cells modelling based on equivalent electrical circuit -EEC-)

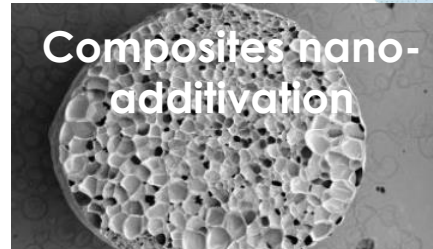
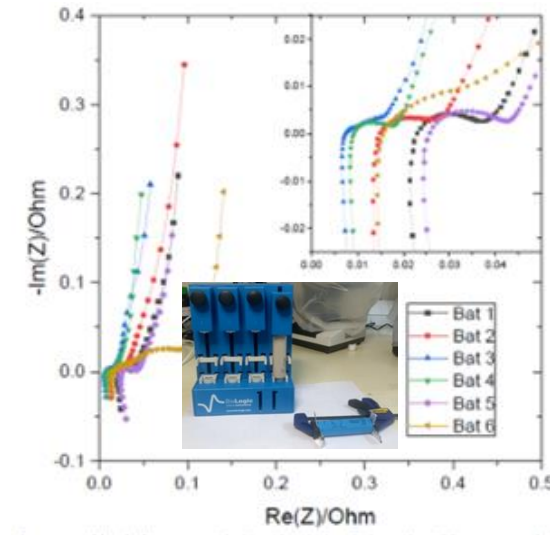
**NANO-ADDITIVATION IN POLYMERS, FOAMS AND COMPOSITES:** melt-mixing and extrusion process for manufacturing of multifunctionality and self-sensing materials.

**CORROSION MONITORING:** electrochemical techniques and embedded fiber optic sensors applied in energy systems.

**GEOPOLYMER CONCRETE, FOAMS AND COMPOSITES:** development of eco-materials based on waste/recycled sources to produce new multifunctional cements/concrete, etc.



Battery cells modelling



Geopolymers



Corrosion monitoring

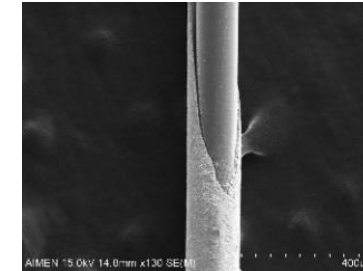


# SMART SYSTEMS AND SMART MANUFACTURING

## PHOTONICS SENSING:

Fiber Optics Sensors: specific sensor development, integration in smart materials and structures, harsh environment monitoring systems .

Optical sensors: biosensors for water quality, VIS/NIR/SWIR spectroscopy sensors for inspection.

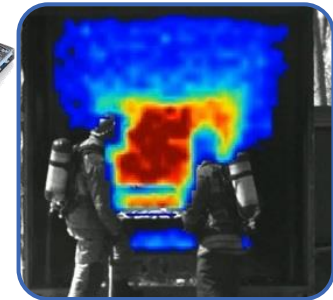
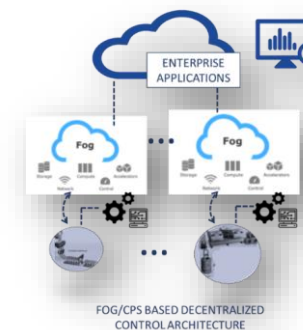


## COMPUTER VISION AND SIGNAL PROCESSING:

Embedded vision systems processing (FPGA/ARM/GPU) and Edge Computing systems (NVIDIA Jetson Nano, NVIDIA XAVIER, Google Coral).

Distributed sensor networks for decentralized monitoring (Edge/Fog/Cloud).

Energy harvesting for IoT applications.



## COLLABORATIVE ROBOTICS:

Multi-layer control systems, visual servoing and dynamic task execution.

Assistance to operators in shared work spaces.

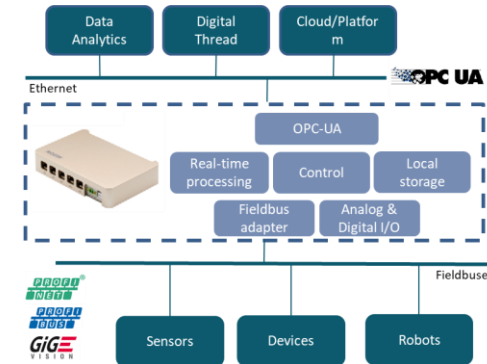
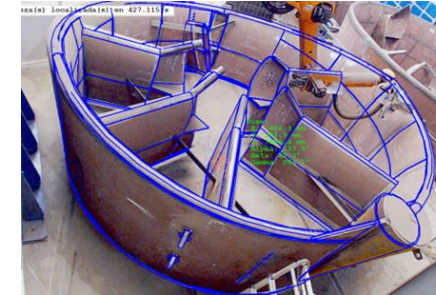
Multi-level perception systems.



# SMART SYSTEMS AND SMART MANUFACTURING

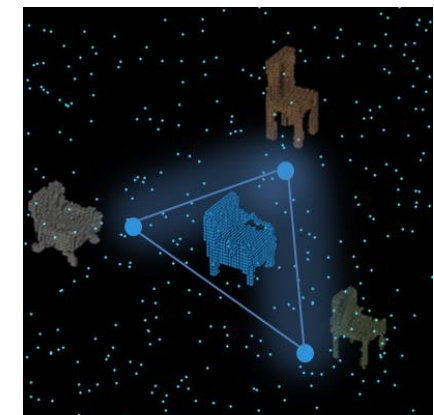
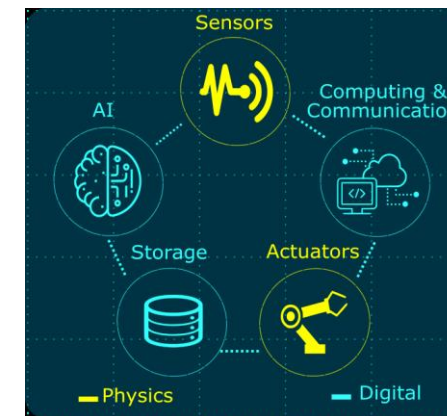
## AUTONOMOUS SYSTEMS & FACTORY AUTOMATION:

Automation for adaptative and flexible manufacturing. Reconfigurability.  
Common interoperable hardware and interoperability for data sharing.  
End-to-end solutions for horizontal and vertical industrial integration.



## DATA ANALYTICS & ARTIFICIAL INTELLIGENCE:

Cognitive systems for manufacturing: Multi-agent systems, Decision Support systems, self-adaptation and reconfigurability of manufacturing processes.  
Predictive maintenance and pattern recognition.  
Generative design for materials and products.





# CIRCULAR ECONOMY AND RESOURCE EFFICIENCY

## NATURE BASED SOLUTIONS:

Treatment/reuse/storage of rainwater and wastewater in urban areas. Resource recovery from agro-industrial wastewater. Sewage sludge stabilisation for fertiliser production.

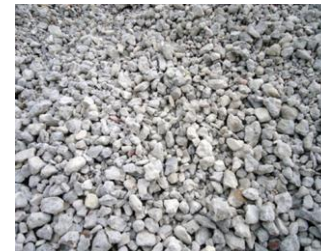
Solutions for climate change adaptation (floods, drought, heat wave, etc.) and mitigation (CO<sub>2</sub> storage).



## WASTE VALORISATION:

Volatile fatty acids and biogas production from organic waste. Biogas upgrading through biological and adsorption processes. Biomethane production from CO<sub>2</sub> and H<sub>2</sub> (Chemautotrophic method).

Funcionalised adsorbents production from inorganic waste for pollutant removal or critical raw material recovery.

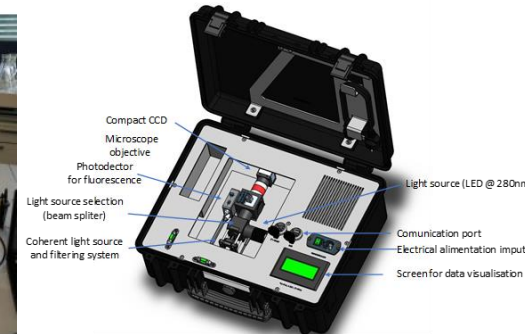
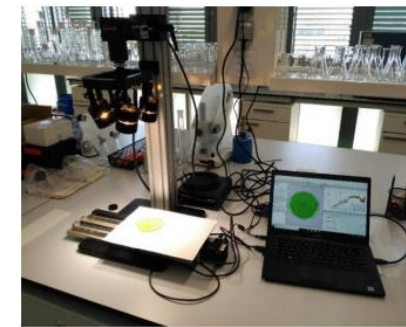


# CIRCULAR ECONOMY AND RESOURCE EFFICIENCY

## ICT FOR WATER AND AGRICULTURAL MONITORING AND CONTROL:

Sensors for bioprocess control and monitoring (VFA, CH<sub>4</sub>, cyanobacteria); water quality (organic matter, ammonium, pathogens, emerging pollutants), agricultural systems (plant status and plagues).

Improvement of water cycle management through IoT, machine learning and artificial intelligence solutions.



## ECO-DESIGN, ECO-EFFICIENCY AND SAFE and SUSTAINABLE BY DESIGN (SSbD):

New products based on principles of eco-design; environmental input-output analysis; scenario development based on Life Cycle Studies (LCA, LCCA, s-LCA); Material Flow Analysis (MFA) to foster resources efficiency and industrial symbiosis; and SSbD criteria as central tools for sustainable development and circular economy studies.





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**Thanks for your attention**

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