IRT M2P

Institut de Recherche Technologique

Matériaux Métallurgie et Procédés

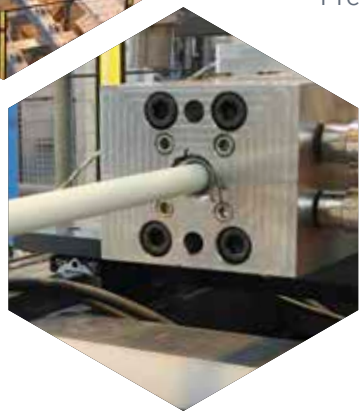
# COMPOSITE MATERIALS

## Materials development and industrialization: new and improved processes and products

Organic matrix composite materials can be defined as a combination of fibrous reinforcements and polymer matrix. Through their properties (good mechanical performances, low density, resistance to corrosion, etc.), these materials help meet today's societal issues and challenges.

IRT M2P's composite materials activity was initially structured around high speed processes and the consideration of environmental impacts. We are now also able to offer a global technological «materials, processes and products» approach adapted to various sectors and markets.

## EXPERTISE & SERVICES



Development of new processes and adaptation/optimization of existing composite processes: volume, net-shape, automation, etc.

Product development: dimensioning, choice of processes and materials, functionalization

Contribution to the development of innovative materials (thermoplastics, hybrids, recyclables, etc.)

Physical process simulation and digital twins

Health, safety and environmental considerations in materials, process, or product development

Product and process monitoring, data acquisition and signal processing

Technical-economical studies and proof-of-concept

Validation and dimensioning of composite structures

Pre-production, technological transfer and training

# TECHNOLOGY

**Preforming**
Development and high-volume production of hybrid preforms (multi-material and multi-structure). Preceding step of injection molding or consolidation, preforming can be done with dry materials or prepreg materials

**Injection Molding processes**
Adapted to thermosets and thermoplastics, RTM or C-RTM processes are mainly used for complex geometries or high-end applications

**Compression molding (SMC, BMC)**
Pressing semi-finished products to produce high-volume complex parts

**Pultrusion**
Continuous process for manufacturing composite sections (which can be hollow bodies). IRT M2P focuses, among other things, on the development of materials, processes and products related to thermoplastic pultrusion

**Automated Fiber Placement (AFP)**
Sometimes associated with additive manufacturing, this process uses successive draping operations to achieve blanks or 3D parts

**Out of autoclave (OoA) thermoforming and consolidation**
The shaping and consolidation of thermoplastic materials is a crucial step that confers thermomechanical properties

**Manual processes, characterization, and laboratory**
Lightweight processes (such as infusion) are widely used for prototyping and manufacturing «small» series of large parts. Coupled with a laboratory environment and characterization, this is an economically attractive and rapid means of implementation

**Simulation**
Use and development of models and software for process simulation and mechanical design of products

# APPLICATIONS

Some examples of IRT M2P developments:
- Health and safety improvements to processes in order to limit operator exposure (closed mold processes and automated treatment)
- Innovative thermoplastic resins
- Composite studs for the tunnel industry
- Composite profiles for construction: development of a modular construction system
- Aerospace components reinforced with 3D woven structures
- Automotive components and high-volume automated production

These technological building blocks can be transfered or adapted to other sectors such as transportation, energy, or defense

# EQUIPMENT @M2P

**AFP CELL**
Coriolis C-Solo with laser and IR heating

**HYBRID PREFORMING PLATFORM**
High volume and automated compatible

**C-RTM PLATFORMS**
High volume and automated compatible

**PULTRUSION LINES**
Pulling force from 6 to 10 T, speed from 25 to 5000 mm/min

**THERMOPLASTIC CELL**
IR oven & hot plate press (up to 450°C)

**VERTICAL PRESSES**
Clamping forces from 180 to 1500 T, platens from 0.25 to 5 $m^2$

**INJECTION & EXTRUSION MACHINES**
Single & multi-component, practical and tutorials compatible

**COMPOSITES WORKSHOP**
Dedicated to manual processes

**CHARACTERIZATION & LABORATORY**
Hexagon 3D scan

**TOOLS & MOLDS**
From the test piece scale to the : 1 scale demonstrator

**Further information on our activities** www.irt-m2p.fr

# RELATED ACTIVITIES

## MULTIMATERIALS JOINING

Development of assembly solutions allowing, amongst other applications, a better integration of composite materials in multi-material structures.

## LIFE CYCLE ASSESSMENT & RECYCLING

In an eco-design approach to composite materials and processes, LCA identifies major environmental impacts so that they can be improved.

### About IRT M2P

The Institute of Research and Technology for Materials, Metallurgy & Processes (IRT M2P) is your partner for developing innovative products and processes to accelerate your company's growth.

We bring our expertise, a wide array of state-of-the-art semi-industrial technological platforms and a network of academic labs to the R&D projects we carry out with our more than 120 industrial partners.

Contact us to discover our 9 areas of technological expertise:

> Advanced Foundry
> Life Cycle Assessment & Recycling
> Metal Powders
> Surface Treatment & Coatings
> Mechanical Surface Treatment
> Heat & Thermochemical Treatment
> Composite Materials
> Multimaterials Joining
> Analysis & Characterization

### Working together

- Multi-partner research projects with private/public co-funding
- Private research studies, tailor-made services
- Small series & prototype production
- Training

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