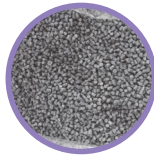


# ON-DEMANDE SMART MATERIALS FROM LABORATORY TO PREINDUSTRIAL SCALE

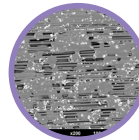
## Polymer & Resin

Elaboration / Formulation, twin-screw extruder line



## Pre-Preg

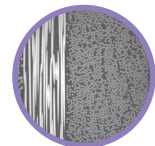
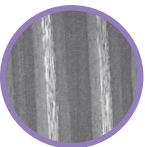
Thermoplastic prepreg pilots



**Enabler for performance & cost reduction targets**

## Fibres & sizing

Fibre sizing line, surface treatment equipment, microscopy analyses

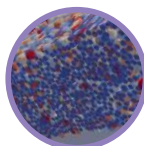


## OOA Process

Automatic Laying, Oven, Induction welding

## Performance

Testing machine, virtual testing




### IRT Saint Exupéry

B612 Building  
3 Rue Tarfaya  
31405 Toulouse Cedex 4 (France)  
Tel. +33 (0) 5 61 00 67 50  
Email: [contact@irt-saintexupery.com](mailto:contact@irt-saintexupery.com)

Arts et Métiers  
Campus de Bordeaux-Talence  
Esplanade des Arts et Métiers  
33405 Talence (France)

Sophia Antipolis Site:  
Inria · 2004 route des Lucioles  
BP 93 · 06902 Sophia Antipolis  
Cedex (France)

 @irtSaintEx  
[www.irt-saintexupery.com](http://www.irt-saintexupery.com)

### NICOLAS CHADOURNE

Email :  
[nicolas.chadourne@irt-saintexupery.com](mailto:nicolas.chadourne@irt-saintexupery.com)  
Tel :  
05 61 00 40 24

## Formulated Materials Laboratory

- Preparation of aqueous impregnation solutions
- Functionalized polymer matrix (PEEK, PEKK, PAEK, PPS, PA): fillers introduction, mix of polymers...

## Characterizations & analysis

- Electrical conductivity (transverse and surface)
- Mechanical performances: compression, CAI, DMA, ILSS, GIC, flexion, vibration, etc.
- Physico-chemical analysis: viscosity, aqueous dispersion stability analysis (Turbiscan®), ATG, DSC, etc.
- Material architecture: fiber volume and weight ratios, porosities, microstructure analysis (optical microscopy, MEB, etc.)
- Polymer crystallization: crystallization kinetics, morphology, etc.

## Fibre/Matrix Interface Analysis

- Pull out test method
- Semi-automatic sample preparation module
- T° max 400°C +/- 1°C
- Heating/cooling speed rate control (master of crystallinity rate)
- Determination of :
  - > maximum force (Fmax)
  - > frictional force (Fb)
  - > debonding force (Fd)
  - > actual embedding length (le)
- Enabling calculation of :
  - > apparent interfacial shear strength
  - > interfacial frictional stress
  - > local interfacial shear strength
  - > critical interfacial energy release



## Extruder

- Co-rotative twin screws
- Heating temperature until 450°C
- Mass Flow rate: from 0,5 to 10 kg/h
- Volumetric feeders for powders and pellets
- Air cooling stand conveyor (1m length)
- 3 feeding positions along the barrel



## Fiber sizing & tow impregnation pilot

- Laboratory pilot to size or impregnate technical fibers (HR/IM/HM, glass, aramid, etc.)
- Line speed up to 10m/min
- Yarn tension control
- Modular units for impregnation and sizing
- Impregnation capability from 1 to 3 spools (sized or unsized)
- Drying and melting oven
- Parallel winding spool technology



## Fiber sizing & tow impregnation pilot

- Pre-industrial pilot for production of UD or fabric carbon thermoplastic prepreg with on demand architecture
- Modular conception pilot adapted to R&T development
- Line speed up to 10 m/min
- Prepreg width up to 300mm (12 inches)
- Different technologies of impregnation : slurry, dry powder, etc.
- Handling of sized or unsized carbon fibre (HR, IM, HM)
- Different unwinding systems under tension controlled : fiber or fabric
- Drying and melting oven for technical thermoplastic polymers (PAEK, PEI, PPS, PA, etc.): temperature up to 400°C
- Compaction unit to control residual porosity inside prepreg materials
- In line prepreg quality control system (thickness, width, etc.)



## Automated Thermoplastic Composite induction welding


- Susceptorless dynamic continuous direct induction welding process
- Welding head powered by a 12kW CEIA induction generator
- > Trajectory repeatability of  $\pm 0.05\text{mm}$
- > Embedded welding head mass up to 35kg
- > Welding of boards with dimensions 80 cmx80 cm
- In line prepreg quality control system (thickness, width, etc.)

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### NICOLAS CHADOURNE

Email :  
[nicolas.chadourne@irt-saintexupery.com](mailto:nicolas.chadourne@irt-saintexupery.com)  
Tel :  
05 61 00 40 24