Scaling-up of Nano-enabled composite materials through a modular R2R pilot line. The SME perspective

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About us

ADAMANT COMPOSITES LTD. is an industrial SME providing solutions on Innovative Materials, Composites & Advanced Manufacturing and Space systems (Deployable structures)

- **SME founded in 2012**
- Limited Liability Company (Ltd) located in Patras (Achaia)
- 16 Employees (engineering, technicians and management)
- 1100m2 industrial space Contractor for European Space Agency
- Active involvement in EU H2020 – ESA research projects

Certified under EN ISO 9001:2008
- Development of Advanced Materials & Structures
- Engineering Services Including Design, Analysis, Assembly & Integration mainly for Aerospace applications & Technology related areas
- Provision of a toll service for Composite Materials Processing
Composites Materials Industry

• Serving demanding markets with different mixture of requirements
• Is continuously growing penetrating new markets (aero, wind, auto etc.)

The need:
• The trend is for stronger growth of *new materials with added functionalities*.

The Constrain:
• High investment on manufacturing equipment has been already made
• Specific manufacturing process have been qualified and need to be respected.
FXply™ prepreg technology

FXply™ prepreg nanotechnology is a non-complex, cost-effective technology that enables conventional prepregs to become functional.

Conventional Materials

Functional Material

- improved toughness
- improved electrical conductivity
- improved thermal conductivity

Processable using standard composite manufacturing technologies:
- Nanomaterial is available in a readily manageable and user-friendly format
- Easy integration into standard industrial processes, such as roll to roll or automated prepreg layup, as well as being suitable for manual layup processes
20 years Nanotechnologies for composites
from expectations to realistic industrial cases
From Lab to Fab

SARISTU
Smart Intelligent Aircraft Structures
FP7-TRANSPORT
(2011-2015)

Open access pilot plants for sustainable industrial scale nanocomposites manufacturing based on buckypapers, doped veils and prepregs
(2015-2018)

Open Access Single entry point for scale-up of Innovative Smart lightweight composite materials and components
(2019-2022)

challenge 1:
- Can your technology provide quantities needed?
- Do you have a enhanced performance?

challenge 2:
- Do you have the equipment with reasonable capability and respective industrial processing know-how and procedures to deliver a Minimum viable product (MVP)?
- Is the performance stable?
- Did somebody from industry used your MVP?
- Have you a Datasheet of your material?
- Do you have some market exposure?

challenge 3:
- Did you solved a real problem of a customer?
- Are you in line with all industrial, commercial directives/laws etc.
- Have you established a solid go to market strategy?
- Do you have solid supply chain?
- Did you improve your product?
From Lab to Fab (The lab line)

- **Non-continuous process**: Prepregs are doped one by one with high changeover time to feed the line.

- **Low product flexibility**: It is only able to produce a unique width which reduces customer applications.

- **Low production rate**: 100sqm/day. Each prepreg end must be removed due to the process (scrap). The process needs to be up scaled to an industrial level.

- **Prototype machinery**: Used machinery is either prototypes for laboratory applications or non-dedicated machinery (machinery used also for other processes). Selected technology is not focused on productivity.
The modular R2R pilot line

- **Semi-continuous process:** Prepregs are manufactured in a semi-continuous roll with minimal changeover time between two rolls.

- **Product flexibility:** The line will be able to produce one width roll which can be cut to lower width rolls to fit ATL and AFP widths. Scattered powder density will also be controlled for every prepreg.

- **High production rate:** 500 sqm/day (5 times the current one). The process is optimized.

- **Dedicated machinery:** Machinery is only used for prepreg manufacturing. Selected technology is focused on productivity.
The modular R2R pilot line

Product Modularity
Developed for pre-impregnated engineering fabrics (prepregs)
Process expanded for:
- fabrics/textiles
- plastics films

Process Modularity
- powder coating module
- New modules under development:
Connected Pilot line

- **State-of-the-art equipment** in all three pilot plants
- **Unique technological expertise** in nano-enabled composites processing techniques
- **Intermediate products**: based on three of the most promising semi-finished products using carbon nanotubes.
INDUSTRIAL USE CASES

PLATFORM – two industrial use cases:

Aeronautical Industrial Use
Case: Fuselage Skin Demonstrator

- Easy integration in composite parts using common manufacturing processes (i.e. RTM, Prepreg)
- Nanomaterial available in a readily manageable and user-friendly format
- Multifunctional performance of composite structures: Enhanced Electrical and Mechanical Properties
- Weight and cost reduction compared to metallic solutions
INDUSTRIAL USE CASES

PLATFORM – two industrial use cases:

Automotive Industrial Use case:
Engine Bonnet Design

- Easy integration in composite parts using common manufacturing processes (i.e. RTM, Prepreg)
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FIAT PANDA

Fiat Panda Engine Bonnet (1430mm x 820mm x 130mm)

Demonstrator #1

Outer Surface

Inner Surface

Demonstrator #2

Outer Surface

Inner Surface

Prepreg Reference Material

CNT doped veil

Buckypaper

Placement of Buckypaper + CNT doped veil on mould

CNT doped veil for enhanced properties at critical load zones

CNT treated prepreg

Buckypaper

Cured CNT treated prepreg + BP

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What is special in SMEs?

Having projects is not enough!  

The end is always visible!

CASH FLOW

Human capital is finite and they need fuel!  

Multi-scale balancing act!
Investing in quality control

MMAMA, Microwave Microscopy for Advanced and Efficient Materials Analysis and Production

Checking how IEMN’s Free Space Antenna can be integrated in ADAMANT COMPOSITES’ Roll-to-Roll pilot line for nano-enabled prepregs
Future Outlook

Open Access **Single entry point** for scale-up of Innovative Smart lightweight composite materials and components (2019-2022)