SmartFAN

Final Project Results

Smart by Design and Intelligent by Architecture for turbine blade fan and structural components systems

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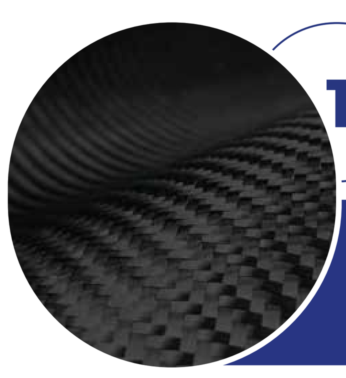
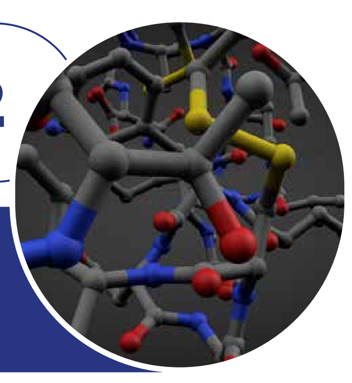
OBJECTIVES

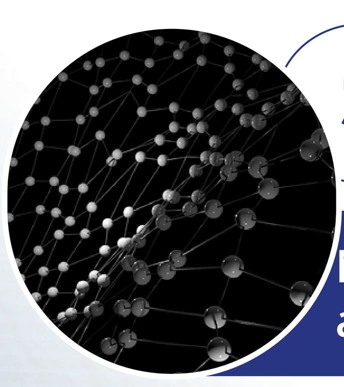
SMARTFAN proposes the development of "smart" material and product architectures, with integrated functionalities, that will interact with their environment and react to stimuli by employing biomimetic, self-sensing, actuating and damage- repairing technologies.
Their smartness is based on bio-inspired engineering and the use of:



1 Surface functionalised carbon fibres (CFs)



2 CF reinforced polymers (CFRPs)



3 Nano-/micro- composites applied on intelligent structures

Special functions of the smart materials involve:
- CFs for reinforcement of the structure and creation of conductivity gradients
- Carbon Nano Tubes (CNTs) and Carbon Nano Fibres (CNFs) for sensing, micro-hollow particles for self-healing
- Electro-magnetic nanoparticles that enable field detection and shielding

RELEVANT TECHNICAL ACHIEVEMENTS WITH SMARTFAN MATERIALS

after 4 years

Supercapacitors have been evaluated through the following tests: Cyclic voltammetry, Activation phase, Capacitive behavior, Chrono-amperometry (CA), Long term galvanostatic: 1000 / 10000 cycles.

Multiscale modelling predicts that graphene reinforced composite has better mechanical properties as compared to GO or rGO reinforced composite at a similar weight percentage of reinforcement.

Aerospace application tested the change of the impression after the heating/ cooling process to assess the response of the shape memory interlayer percentage of reinforcement", with something more representative for the project.

Recycling and reclamation of CFRPs reinforcement was achieved from thermoset polymers through pyrolysis and thermoplastics within SmartFan were tested on their reprocessing for 3D printing filament production applications.

Thermally responsive fan prototypes were developed using continuous fiber 3D printing and custom toolpath generating algorithms.

Fit for potential industrial production is the characteristic which has been conferred to the Latene + 5% CNT compound.
Studies consider it completely OK from a safety point of view for fan wheel application.

Aging protocols considered in the project (T+H: temperature + humidity, UV: ultraviolet) have been concluded that a slight effect has been observed in the mechanical properties for the UV aging (reduction of around 10 %) while no influence has been evidenced for the T+H aging of the material.

Nanocomposites and carbon fiber (CFs) reinforced polymers (CFRPs) presented an increased tensile strength of 8.5 and 12.8% for CFs sized with CNTs and CNFs respectively.

Axial cooling fan prototype with shape morphing composite blades for thermal managing applications

DETAILS

- **PROJECT REFERENCE:** 760779
- **START/END:** Jan 2018 – Dec 2021
- **EU CONTRIBUTION:** EUR 7,989,601.25
- **PROGRAMME ACRONYM:** SMARTFAN
- **CALL IDENTIFIER:** H2020-NMBP-2017-two-stage
- **TOPIC:** NMBP-04-2017 Architectured/Advanced material concepts for intelligent bulk material structures

CLUSTERS

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