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H2020-MSCA-RISE-2016-734164
Graphene 3D

MULTIFUNCTIONAL GRAPHENE-BASED NANOCOMPOSITES WITH ROBUST ELECTROMAGNETIC AND THERMAL PROPERTIES FOR 3D-PRINTING APPLICATION

Graphene 3D is a project funded by the European Commission within the EU H2020 "MARIE SKŁODOWSKA-CURIE RESEARCH AND INNOVATION STAFF EXCHANGE" program.
The 48-months project commenced on 01/01/2017 with coordination by the Institute of Mechanics, Bulgarian Academy of Sciences (IMech-BAS), the Open Laboratory on Experimental Micro and Nano Mechanics (OLEM).

The main goals of Graphene 3D are:

- Develop and fabricate polymer nanocomposite material, doped by a mix of graphene and carbon nanotubes, with multifunctional property enhancement of the host polymer and high improvement potential, for 3D printing application.
- Use the multifunctional nanocomposite material to fabricate optimized 3D printed cellular structures with extraordinary electromagnetic wave absorption, high thermal conductivity, mechanical strength and lightness that have strong potential for application in new generation EM sensors, detectors, or heat exchange devices for power electronics.

PROJECT OBJECTIVES:

1) Develop effective processing technique for fabrication of graphene-based polymer composite;

2) Achieve highly improved nanocomposite properties (electrical, electromagnetic, mechanical, thermal) at low percolation threshold;

3) Propose robust design tool to optimise formulation of nanocomposites with superior properties, suitable for 3D printing application, e.g. fused deposition modelling (FDM), and selective laser sintering (SLS);

4) Design nanocomposite cellular structures with optimum configuration (structure, geometry) and improved multifunctional characteristics in view of predefined performances;

5) Prove of design concept by fabrication and experimental validation of:

(i) multifunctional graphene-based nanocomposite material with extraordinary properties, suitable for 3D printing, and

(ii) 3D printed multifunctional cellular structures that achieve: almost perfect electromagnetic absorbance (>80%) in the range 1-100 GHz; high thermal conductivity (1-2 W/mK); enhanced (>20%) Young's modulus; low percolation threshold of the nanofiller (<1 wt%) and lightweight (0.1-0.2 g/cm3), those having strong potential for application in high power electronics;

6) Create a Joint Laboratory on Graphene-Polymer Research for knowledge share within the multidisciplinary international and inter-sectoral consortium having long-term implication on future applications of the nanomaterials.

WORK PACKAGES:

WP1. Project management and coordination.

WP2. Processing and rheological of graphene-based nanocomposites.

WP3. Characterization of nanocomposite hybrid structure and morphology.

WP4. Characterization of nanocomposite properties around and above percolation threshold.

WP5. Robust nanocomposite design and optimization of material's formulation for 3D printing application.

WP6. Modeling, simulation and optimization of nanocomposite based multifunctional cellular structures with pre-defined properties.

WP7. Prove of design concept by experimental validation of 3D printed nanocomposite cellular structures. Application specifications

WP8. Dissemination and exploitation of results, IPR, networking and communication strategy.

WP9. Ethics requirements

Kick-Off Meeting, 24-25 January 2017, Brussels