European Union-NextGenerationEU

Project BG-RRP-2.011-0001-C0: „**Smart filament of biodegradable polymers with graphene for 4D-printing with thermo-stimulated shape memory (t-ShM) activated by resistive heating”**

Acronym: **t-ShM Filament**

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Overview

The project aims to develop electroactive nanocomposite filament of biodegradable polymers with graphene for 4D-printing (4DP) with “thermo-stimulated shape memory” (t-ShM) activated by Joule heating. The new 4DP technology is the next generation of additive manufacturing, which adds unique features to 3D printed architectures under the influence of external stimuli. The 4DP concept requires a ShM (shape memory) material with specific properties; sensitivity to external stimuli; and structural design that are necessary to unlock the potential of functionality. In the project, we will develop a multicomponent polymer-polymer nanocomposite with graphene, that demonstrate high elasticity, electroactivity and thermal properties. An innovative t-ShM filament and 4D-printing technology will be developed, with a representative model for testing in a simulated Joule heating environment. We will optimize the temperature transitions for t-ShM depending on the electroactivity and the nanocomposite properties. The expected outcome of the project is: Biodegradable, multifunctional t-ShM filament for 4D-printing (FDM), demonstrated with a Basic Prototype that, at successive transition temperatures activated with Joule heating, unlocks reversible thermo-stimulated effects such as self-heating, self-actuation and self-healing from defects. The innovative t-ShM filament will have great potential for printing objects with complex shapes and reversible thermo-stimulated effects, that is suitable for many revolutionary applications. This material is biodegradable, recyclable and will reduce the carbon footprint of the rapidly developing additive technology.

Key words: filament, biodegradable, biocompatible, 4D-printing, t-ShM, self-heating, self-actuation, self-healing

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