3D-printable bio-based functional materials

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Bio-based photocurable polymers are increasingly demanded as environmentally friendly materials for advanced applications, in particular those processable by additive manufacturing technologies. In fact, the consumption of non-renewable energy and the carbon dioxide emission can be reduced through the use of natural-based materials, being bio-based thermoplastics widely available but bio-based thermosets still limited. In this scope, vegetable oils, terpenes and carbohydrates are among the most used monomers for the manufacture of bio-plastics [1]. Particularly, oils obtained from vegetables are the most important renewable feedstock employed in the synthesis of photocurable bio-based materials and soybean oil stands out as it is one of the vegetable oils with largest global production volumes, most economical prices for large-scale use, presents good mechanical properties, low curing time in the presence of photoinitiator and high thermal stability [2]. Together with functional fillers, bio-based photocurable polymers can represent a next step for the generation of functional and active smart materials. Among fillers, carbon-based materials are particularly suitable for developing multifunctional sensing materials, as they present thermal stability, low toxicity, flexibility and high electrical and thermal conductivities [3].

In this work, we have investigated the addition of different amounts of carbonaceous fillers to acrylated epoxidized soybean oil showing the effect on mechanical, thermal, electrical and functional properties of crosslinked materials. The piezo- and thermo-resistive behaviours were evaluated, showing the suitability of the composites UV-cured materials as sensors with similar responses to the ones obtained for petroleum-based materials.

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