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Book of Abstracts

Innovative Technology and Manufacturing Processes to Realize Structural Smart Composites

Chaired by:
Prof. Liberata Guadagno & Prof. Roberto Pantani (University of Salerno, Italy)

Multifunctional nanostructured composites containing biomass-derived functional additives

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Abstract: Due to their superior thermal stability and chemical resistance, epoxy resins represent a primary choice in several industrial applications, including the manufacturing of protective and functional coatings. The addition of properly designed fillers allows for the preparation of epoxy coatings showing surface hydrophobicity, anti-icing, shape recovery capability, luminescence, and improved flame retardancy that is required to contrast the high flammability of such materials. Herein, we propose two approaches to enhance these properties by sustainable sol-gel methodologies: the functionalization of hemp microparticles (HMPs), obtained from waste hemp fibers, to turn them into hydrophobic and anti-icing fillers, and the tailoring of carbon quantum dots (CQDs), hydrothermally synthesized starting from humic acids, to make them able to act as flame retardant and hydrophobic additives. A low content of HMPs (i.e., 2 wt.%) cast on aeronautical carbon fiber-reinforced panels increased both their hydrophobicity, giving a water contact angle (CA) 30° higher than that the uncovered panels, and the icing time at -30 °C, which was doubled than unfilled epoxy resin coatings. On the other side, 0.1 wt.% of silanized CQDs incorporated into the epoxy matrix, without using phosphorus and halogen based flame retardants, could lead to nanocomposites exhibiting photoluminescence, high hydrophobicity (up to 137° of CA), fire resistance, and heat/flame-triggered shape recovery features.

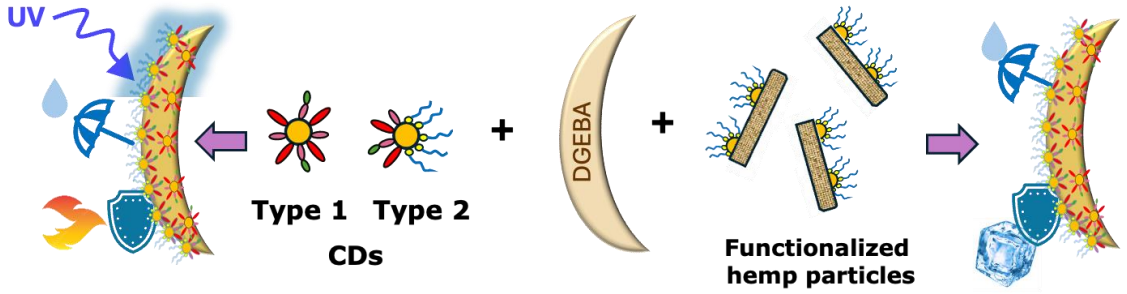

Figure 1: Synthesis strategies for the production of hydrophobic epoxy-based coatings