Green Synthesis of Boron Doped 3D Printable Microcomposites from Plastic Wastes for Solar and Nuclear Absorption Applications

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Plastic pollution has become one of the most pressing environmental issues in the world due to low-recycling rates. In this study, I developed a general recycling method, Liquid Floating Process or LFP, to apply to many polymer types, through which applicability of sustainable energy storage systems was examined. The process of creating a qualified end-product examined in two stages. In Stage I, with the LFP, boron-doped polymers were produced and collected by electrodeposition. The polymeric structures formed were used to create a 3D printable, rBDPE/B4C micro composite to be used as a solar and nuclear absorbent. LFP will be the first thermocatalic and solvent-free general recycling process in commercial methods with high-yielded, sustainable and cost-effective benefits. In Stage II, micro-unit structures of the boron were used to create a macro level surface by the micro-inspired technique, aiming to increase the surface area per unit volume to be used in smart materials. The microcomposites created were characterized by FT-IR, DSC, and TGA techniques. In addition, qualitative and quantitative examination of cobalt color change test and preliminary titrations were also used in the calculation of the yield. UV-Vis DRS, NAA and UV-Solar Simulator were used in the solar and nuclear absorbent capacity of microcomposites. The performance of the rBDPE/B4C microcomposites in these tests was also an increased neutron attenuation coefficients (u) in samples and showed the PV effect in the simulator. Economical and theoretical analysis showed that yield for the plastic wastes is 45% higher than the commercial methods. These properties can be exploited in future studies to develop an effective polymeric space-based solar power absorber and energy storage systems.