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Intrinsically Dual-Doped Conductive Polymer System for Electromagnetic Shielding Applications

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Abstract : Currently, the global concerning fact about electromagnetic pollution (EMP) is that it not only adversely affects human health but rather projects the malfunctioning of sensitive equipment both locally and at a global level. The market offers many incumbent technologies to solve the issues, but still, a processable sustainable material solution with acceptable limits for GHG emission is still at an exploratory stage. The present work offers a sustainable material solution with a wide range of processability in terms of a polymeric resin matrix and shielding operational efficiency across the electromagnetic spectrum, covering both ionizing and non-ionizing electromagnetic radiations. The present work offers an in-situ synthesized conducting polyaniline (PANI) in the presence of the hybrid dual dopant system with tuned conductivity and high shielding efficiency between 89 to 92 decibels, depending upon the EMI frequency range. The conductive polymer synthesized in the presence of a hybrid dual dopant system via the in-situ emulsion polymerization method offers a higher surface resistance of 1.0 ohms/cm with thermal stability up to 2450C in their powder form. This conductive polymer with a hybrid dual dopant system was used as a filler material with different polymeric thermoplastic resin systems for the preparation of conductive composites. Intrinsically Conductive polymeric (ICP) composites based on hybrid dual dopant systems were prepared using melt blending, extrusion, and finally by, compression molding processing techniques. ICP composites with hybrid dual dopant systems offered good mechanical, thermal, structural, weathering, and stable surface resistivity properties over a period of time. The preliminary shielding behavior for ICP composites between frequency levels of 10 GHz to 24GHZ offered a shielding efficiency of more than 90 dB.

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