Abstract

In the present era, the advanced technology demands for the fabrication of light weight and high performance electromagnetic interference (EMI) shielding materials with enhanced microwave absorption property for adaptable shielding application in the area of modern electronic gadgets and telecommunication devices. Several research works reveals the potential of various conducting polymer composites as efficient shielding material. The EMI shielding in a material occurs by three mechanisms: reflection, absorption and internal multiple reflection of the microwave. The EMI shielding of polymer composites depends on its electrical conductivity, permeability, permittivity and morphological properties. The high electrical conductivity benefits the microwave absorption property of polymer composites. Various procedures are reported for achieving higher electrical conductivity in a composites that facilitates the EMI shielding efficiency (SE). The inhomogeneity in the polymer composites developed by multiphase formation, segregated and porous morphology, foaming structure etc., facilitate the internal multiple reflection of microwave that finally is absorbed by the conductive network presents in the polymer matrix.

In this work, efforts have been put forward to develop multiphase and porous polymer composites based on different conducting carbonaceous nanofillers (MWCNT, carbon nanohorn and graphene) with light-weight and enhanced microwave absorbing property. Several electrically conducting polymer composites with high EMI SE were prepared through *in-situ* polymerization of monomers and solution blending method, in presence of the nanofiller. A significantly high electrical conductivity of the composites was obtained at very low loading of the conducting nanofiller through selective dispersion of the nanofiller in the matrix phase. The effect of electrical conductivity on microwave absorption property, as well as, EMI SE has been discussed in this work. A high EMI SE has been achieved in the composites with enhanced microwave absorption property. Various procedures have been developed to create the inhomogeneity in the PCL, PS, PMMA, PVDF and PDMS matrix to facilitate the internal multiple reflection of microwave in the polymer composites that enhanced the absorption of the microwave. The effect of magnetic material (Fe_3O_4) decorated conducting polymer (polyaniline) as filler on electrical conductivity and EMI SE in polymer composites was also investigated. Polymer composites with porous morphology was developed for achieving tunable EMI SE in the composites through pressure induced compressibility. The morphological, structural, electrical, thermal, mechanical and shielding properties of the prepared polymer composites have been discussed in detail in the thesis.

KEYWORDS: Polymer, Carbonaceous nanofiller, Microstructure, Electrical conductivity, Electromagnetic shielding efficiency, Microwave absorption.