

Facile preparation and enhanced electromagnetic wave absorption properties of Fe₃O₄@PVDF nanocomposite

ABSTRACT

Fabrication and investigation of microwave absorbing materials have been widely explored to mitigate the emerging EM pollution. In this study, we prepared magnetite (Fe₃O₄) nanoparticles via a rare facile sol–gel method followed by a calcination process. Then, Fe₃O₄ and polyvinylidene fluoride (Fe₃O₄@PVDF) nanocomposite were prepared and the electromagnetic wave absorption (EMWA) properties were studied using the finite element method. Characterization techniques employed in this study include; X-ray diffraction, Fourier-transform infrared spectroscopy (FTIR), vibrating sample magnetometer (VSM), Field emission scanning electron microscopy (FESEM) and Transmission electron microscopy (TEM). The microwave absorption properties of Fe₃O₄@PVDF were studied at the X-band (8.2–12.4 GHz) and Ku-band (12.4–18 GHz) frequency range. The Fe₃O₄@PVDF nanocomposite displayed minimum reflection loss of –62.7 dB at 16.9 GHz for 3.5 mm thick sample. These outstanding EMWA coefficients could be attributed to favorable impedance match from outstanding dielectric and magnetic loss mechanisms.

Keyword: Microwave absorption property; Magnetite nanoparticles; PVDF; Reflection loss