Abstract

Nanocomposites based on polystyrene-$ZnFe_2O_4$ were synthesized by using the micro-emulsion method. Ferrite was prepared by using $Fe(NO_3)_2$ and $Zn(NO_3)_2$ along with CTAB (Cetyl Trimethyl Ammonium Bromide) as surfactant to reduce surface tension. Composites prepared with PST to $ZnFe_2O_4$ ratios of (4:0, 4:1, 4:2, 4:3, 4:4, 0:4) were characterised for the applications of microwave absorption using XRD, SEM, FTIR, VSM and Impedance Analyser. XRD peaks were found at (220), (222), (311), (212), (400), (331), (511) and (440) *hkl* planes with a most preferred peak at (311). Results confirmed the spinel structure of $ZnFe_2O_4$ and existence of prepared sample as well, with a crystallite size of 12.58 nm for a sample having ratio 4:1 and 14.94 nm for that which has equal ratio of both contents. Average crystallite size of pure $ZnFe_2O_4$ was found almost 15.30 nm and it was observed that size was found increasing by increasing ferrite content. FESEM gave the optimised results of surface morphology and the crystallite size measured by XRD found in close approximation to the reported values. Two main broad metal–oxygen bands detected using IR spectra of spinel ferrite nanoparticles correspond to the intrinsic stretching vibrations of the metal at the tetrahedral site (observed from 837.9 to 1034.3 cm^{-1}) and traces of organic materials were observed at 1499.2 and 1766.4 cm^{-1}, which are associated with C=O and C=C stretching vibration respectively. O-H stretch of COOH weak acid of the carboxyl group was found at 2978.7 cm^{-1}. Dielectric properties were measured using Impedance Analyser. The composite with 4:4 ratio showed constant behaviour of dielectric constant at lower frequencies of applied electric field but resonance at almost 2.5 GHz shows that it is good enough for dispersion of electric part of microwaves. Magnetic properties were measured by using VSM. The magnetization for pure ferrite ($ZnFe_2O_4$) was found 1.49 emu/g at 15000 Oe and for composite, with the same ratio of ferrite and polystyrene, 0.54 emu/g. It was concluded after characterization that these composites are best candidates to employ as microwave absorbing materials.