Attenuation performance of polymer composites incorporating NZF filler for electromagnetic interference shielding at microwave frequencies

ABSTRACT

Polymer composites have been thoroughly explored for future electromagnetic interference (EMI) applications owing to their unique combination of electrical, mechanical, and optical properties. The composition, morphology, and surface characteristics of the filler material play critical roles in regulating the composite activity. We studied the formation, synthesis and EM attenuation properties of nickel zinc ferrite (NZF) + Polycaprolactone (PCL) microcomposites that were prepared via the conventional mixed oxide (CMO) technique. Compared with other preparation routes, CMO may provide the advantages of a simple process and the ability for mass production and controlled product formation. A rectangular waveguide connected to a vector network analyser coaxial cable was employed to measure the scattering parameters [S] for use in determining the attenuation values of NZF+PCL substrates for a variety of NZF% values. Measurement tests showed a simultaneous increment in the attenuation value with the filler percentage. NZF+PCL samples of 1-mm thickness were able to attenuate microwave frequencies by up to ~3.33 dB, where the highest attenuation magnitude of 8.599 dB over a large area was attributed to the 12.5% NZF filler content at 12 GHz. Thus, a low transmission of waves resulted from the high shielding effectiveness (SE) values that showed a maximum 6.86 dB EM interference. Scanning electron microscopy (SEM) was utilized to analyse the average particle size (1.45 μm) of the filler powder.

Keyword: Microwave; Rectangular waveguide; Composites; FTIR; SEM and T/R coefficients