Electromagnetic wave absorbing characteristics of C/Co-Mn and C/Co-Zn doped barium hexaferrite sandwiched nanocomposites

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ABSTRACT
The development of high reflection loss and broad frequency bandwidth for microwave absorbing materials (MAMs) has been intensified in recent years. Carbon nanocomposites have stimulated attention as the EM-wave absorbing materials due to their high conductivity with high dissipating capability of electrostatic charges and EM-wave radiation shielding. In this study, we report on the analysis of microwave absorption through absorption spectrum of carbon/barium hexaferrite nanocomposites with Co-Mn and Co-Zn as dopants. The nanoparticles of Co-Mn-doped and Co-Zn-doped barium hexaferrites were synthesised using the mechanical alloying technique. The resultant particles were then mixed thoroughly with epoxy resin with ratio of 8:92 wt.% prior to sandwich with carbon black layer at different thicknesses of 1, 2 and 3 mm to form nanocomposites. The samples were characterised on their morphological, magnetic and microwave properties using field emission scanning electron microscope (FESEM), vibrating sample magnetometer (VSM) and vector network analyser (VNA) respectively; there follow rational discussions on the effect of dopant substitutions and microstructure on the absorption/reflection loss and bandwidth broadening of MAM. The results show that the saturation magnetisation of $BaCoZnFe_{16}O_{27}$ is higher as compared to that of $BaCoMnFe_{16}O_{27}$ and pure $BaFe_{12}O_{19}$ in which Zn behaves as an ion modifier that compensates the magnetic moment in hexaferrite sublattices, thus translated into an increase of net magnetic moment per unit volume of the sample. By using carbon black as a matching layer and $BaCoMnFe_{16}O_{27}$ as an absorbing layer with total sandwich thickness of 2 mm, the highest reflection loss of 39.83 dB was obtained. The capability to tune the absorption and bandwidth of all the samples at various frequencies indicates that these materials would be a superior MAM. Through scrutinisation of relationship between absorption/reflection loss with different dopants and thickness variation, further discussion on mechanism of adsorption/reflection characteristics for research optimisation would be provided.

KEYWORDS
MAMs; Microwave absorbing materials; Ferrites; Magnetic materials; Nanocomposites; Microwave absorption; Dopant variations; Magnetic properties

ACKNOWLEDGMENTS

The authors would like to express appreciation for the financial support from Universiti Malaysia Pahang Internal Research Grant Vote No. RDU1803124 and Long Term Research Grant Scheme Vote No. 5526244.