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Comparative study of single- and double-layer $BaFe_{12}O_{19}$-Graphite nanocomposites for electromagnetic wave absorber applications

Ismayadi Ismail [a], Idza Riati Ibrahim [a], Khamirul Amin Matori [ab], Zaiki Awang [c], Muhammad Misbah Muhammad Zulkimi [a], Fadzidah Mohd Idris [d], Rodziah Nazlan [e], Raba'ah Syahidah Azis [ab], Mohd Hafiz Mohd Zaid [b], Siti Nor Ain Rusly [a], Mehmet Ertugrul [f]

[a]*Materials Synthesis and Characterization Laboratory, Institute of Advanced Technology, Universiti Putra Malaysia 43400 UPM Serdang, Selangor, Malaysia*

[b]*Department of Physics, Faculty of Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia*

[c]*Microwave Research Institute, Universiti Teknologi MARA, Shah Alam, 40450, Malaysia*

[d]*GENIUS Insan College, Universiti Sains Islam Malaysia, Bandar Baru Nilai, Nilai, Negeri Sembilan 71800, Malaysia*

[e]*Department of Materials Technology, Faculty of Industrial Science and Technology, Universiti Malaysia Pahang, Kampus Gambang, Lebuhraya Tun Razak, Kuantan, Pahang, Malaysia*

[f]*Department of Electronics, Engineering Faculty, Ataturk University, Erzurum, 25240, Turkey*

Abstract

The development of stealth technology for military applications and increasing concerns of electromagnetic pollution have garnered interest to design microwave absorbing materials with wide absorption bandwidth and effective absorption properties. Two batches of samples as a potential radar absorbing material were prepared in this study: single-layer and double-layer nanocomposite mixtures of graphite and barium hexaferrite nanoparticles. Characterizations of electromagnetic and microwave absorbing properties were carried out in the frequency range of 8–12 GHz (X-band) and 12–18 GHz (K_u-band). Single-layer samples with thickness of 2 mm showed optimal absorption properties with minimum reflection loss of -20.5 dB at 11.8 GHz for X-band and -20.7 dB at 14.7 GHz for K_u-band, displaying bandwidths of 0.6 GHz for the former and 3.8 GHz for the latter at -10 dB. On the other hand, double-layer samples made of 1 mm thick barium hexaferrite matching layer and 2 mm thick graphite absorbing layer showed optimal absorption properties with minimum reflection loss of -30.0 dB at 9.2 GHz for X-band with narrower bandwidth of 0.6 GHz. The microwave absorption properties of these nanocomposites were attributed to combined effect of dielectric loss from graphite and magnetic loss from ferrite.

Keywords
Barium hexaferrite; Reflection loss; Microwave absorbers