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Microwave Absorption of Nylon 6,6 Based Polymer Ferrite Composites

G. Vamsi Krishna¹, Philip Kurian¹, M.R Anantharaman²

¹Department of Polymer Science and Rubber Technology, Cochin University of Science and Technology, Cochin, Kerala, India

²Department of Physics, Cochin University of Science and Technology, Cochin, Kerala, India
Email: gvk.cusat@gmail.com

Abstract

Ferrite composites are magnetic composites consisting of fine particles of metal ferrites dispersed in the polymer matrix. These composites have a variety of applications as flexible magnets, pressure / photo sensors and microwave absorbers. Polymers and magnetic materials play a very important role in our day to day life. Both natural and synthetic polymers are today indispensable to mankind. The polymers, which include rubber, plastics and fibers, make life easier and more comfortable.

Two different ferrites, barium ferrite and nickel ferrite are used in the present study. Nickel ferrite prepared by sol-gel method and barium ferrite prepared by the ceramic method was used for this study. Preparation techniques are chosen based on the particle size requirement and the net properties required. Ferrites from Sol-Gel method don't require any high energy ball milling as their particle sizes are already in the nano scale, but ferrites from the Ceramic method require high energy ball milling so as to reduce the particle size. The prepared ferrite samples were analysed using x ray diffraction (XRD) technique. From the XRD patterns the particle size was calculated and comparison with the respective standard JCPDS values.

These ferrites were then incorporated into Nylon 66 matrix by melt mixing using a Brabender Plasticorder and composite with varying ferrite loading was prepared. The test specimen for evaluating the dielectric, magnetic and microwave properties were moulded from these composites.

The dielectric properties were measured using a dielectric cell and an impedance analyser (Model: HP 4285A) in the frequency range 0.1-8 MHz. The magnetic characterisation of the ferrites and polymer ferrite composites were carried out using Vibrating sample magnetometer (VSM) and the Parameters like saturation magnetisation (M_s), magnetic remanance (M_r) and coercivity (H_c) were evaluated. Microwave absorption properties were measured from insertion loss of the samples by closely inserting the samples between the two waveguide with coaxial adapters.

These ferrite based composites can be used for many applications in the fields of microwave absorbency. Ferrites are highly resistive ferrimagnetic oxides, which exhibit ferromagnetic resonance (FMR) in the micro-and mm-wave region. This makes them also suitable for micro- and mm-wave devices and absorbers.

References

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