DEVELOPMENT AND CHARACTERISATION OF RADAR ABSORBING MATERIALS

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Introduction

Radar Absorption Materials (RAM) must be able to reduce to zero the reflection coefficient of incident waves. The absorbers find applications in commercial and military hardware. In commerce, the materials are used for shielding of electronic equipment under testing from electromagnet interference. Installation of RAM materials on a tower structure located next to an airport enables the attenuation of radar reflections interfering with the airport radar. In military, the materials are utilised in stealth technology and other air defence systems. There are several types of RAM available on market, such as elastomers, polymers, chiral and ferrite composites. Recently, ferrites have been used for electromagnetic wave absorbers Ferrite materials are selected for two important reasons. First, our laboratory has made major advances in ferrite technology. Second, ferrite has a unique and superior property compared with other lossy materials. The present project aims at fabrication and characterisation of ferrite composites that can meet criteria as RAM.

Materials and Methods

Commercially and traditionally, ferrites are used as cores for inductors and transformers. As such, ferrites, which have high initial permeability and low loss, are preferred. These RAM must be able to suppress the reflection so that the reflectivity at the incident plane reduces to almost zero. Theoretically, this can be achieved by formulating the materials to posses appropriate values of the permeability and the permitivity constants. Sample thickness of a quarter wavelength will more or less fix the real part of the permeability complex over a wide range of frequency. Since permeability and the permitivity are strongly dependent on materials compositions, proper and careful choice of composition is essential. A small amount of dielectric material may be added for fine-tuning of the magnetic and the dielectric losses.

Results and Discussion

In the present work, five ferrite composites have been prepared:

$NiFe_2O_4$+dielectric+PVC,$Ni_xZn_{(1x)}Fe_2O_4$+dielectric+PVC, $MgFe_2O_4$+dielectric+PVC,

$Mg_xNi_{(1-x)}Fe_2O_4$+dielectric+PVC,$Ni_xZn_yCu_{(1x)}Fe_2O_4$+dielectric+PVC

Each ferrite was first prepared using the powder technique. It was then mixed thoroughly with a small amount of dielectric and polyvinyl alcohol (PVC) to act as a binder.

Conclusions

For the measurement of the complex permeability, the saturation flux density and the electrical resistivity, samples were first prepared in toroidal shapes. The reflection and the transmission coefficient were measured on HP 8720B network analyser over a frequency range of 2 Ghz-18 Ghz. However, due to frequent problems with the analyser, such measurements have not been made.

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