Volume : 2 | Issue : 4 | April 2013 • ISSN No 2277 - 8160

Research Paper | Physics

Electromagnetic Interference Shielding Effectiveness (EMI-SE) on PANI-PBO Composites

Sharadatayi Patil — Department of Physics, Singhania University, Pacheribari Jhun jun rajestan, India

Sangshetty Kalyane — Department of Physics BKIT Bhalki, Dist: Bidar, Karnataka, India -585328.

ABSTRACT

Development of conducting polymers with wonderful electrical and optical properties witnessed significant progress in the last decade. Polyaniline (PANI) has received much attention because of its unique reversible proton doping, high electrical conductivity ease of preparation and low cost. The demand of high quality materials for electromagnetic compatibility is alarmingly increasing. Conventional microwave absorbing materials such PbO in the powder form were blended with polyaniline as base at different proportions (10.30 and 50wt%), These polymers (Polyaniline/ PbO) composites were studied for microwave absorption properties such as Shielding Effectiveness were evaluated from S parameter measurements. The new material exhibits very good electromagnetic interference shielding efficiency (EMI-SE) compared to previously developed PANI based composites and is a potential candidate for EMI shielding

KEYWORDS :

I. Introduction

The electromagnetic radiation interference is one of the unfortunate by-products of the rapid proliferation of electronic devices. These are undesired conducted or radiated electrical disturbance including transients which can interfere with the operation of electrical or electronic components. The polymer materials have attraction for microwave radiation absorbing and shielding materials in the GHz frequency range due to their unique chemical and physical properties. The shielding material is very important in microwave absorbing materials for lightweight and strong absorption properties [1]. The use of plastic materials to the housing of computer and electronic devices has been growing very rapidly due to their advantages over metals, like light weight, design flexibility, low cost and easy to mass production. As such plastic casing of electronic equipment do not provide protection from external field [2]. Composites such as metal particles, metal flakes, carbon particles, carbon fibers are extensively employed in electromagnetic interference (EMI) **s**hielding [3-5], we have synthesized conducting polymer composite with a PbO. The present investigation deals with the shielding effectiveness of the polyaniline composites, we have studied microwave absorption properties of these composites in X band microwave region.

II. Experimental

II.1. Synthesis of PANI and PANI-PbO composites

0.1 mol of aniline was dissolved in 1M HCl to form Polyaniline (PANI). Lead oxide (PbO) is added in the weight percent of 10, 30, and 50 to PANI solution with vigorous stirring in order to keep the Lead oxide (PbO) suspended in the solution. To this reaction mixture, 0.1 M of ammonium persulphate [$(NH_4)_2S_2O_8$] which acts as the oxidant was added slowly with continuous stirring for 4 – 6 hours at 0 – 5 ^{0}C. The precipitated powder recover was vaccum filtered and washed with de ionized water. Finally the resultant precipitate was dried in an oven for 24 hours to achieve a constant weight. In this way 3 different polyaniline - PbO composites with different wt % of PbO (10, 30, and 50) in polyaniline have been synthesized. All the composites so obtained above are crushed into fine powder in an agate mortar in the presence of acetone medium.

III. Results and Discussions

Figure-1 shows the variation of real (ε′) part of the permittivity at X-band frequency. The ε′ spectra show variation in the whole frequency range. However the ε′ values increased with the increase of frequency in multi bands and ε′ value increase with the decrease of PbO content in Polyaniline and this may be due to interfacial polarization.

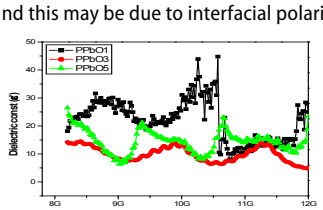

Figure 1 Shows the Variation of Dielectric constant (ε′) Vs Frequency (PANI / PbO)

Figure-2 shows the variation of ε″ with frequency, spectra also shows the decrease of ε″ value with the increase of frequency in multi bands. 30wt% of PbO in PANI shows maximum value, this may be due to the lag in polarization vis a vis the applied field.

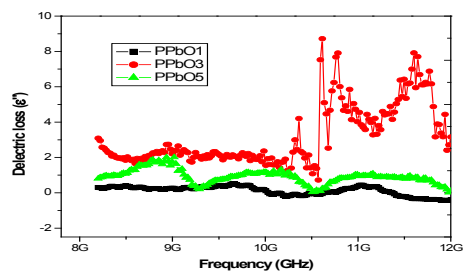

Figure 2 Shows the Variation of Dielectric loss (ε″) Vs Frequency (PANI /PbO)

Figure-3 shows the variation of EMI-SE at X-band frequency (8 to 12 GHz). The EMI-SE spectra of all the sample shows multiple bands except 10wt% of PbO in PANI with significant variation in the whole frequency range. However maximum EMI-SE values is observed for 10 wt% $PbO_{in\ PANI}$ and also observed that different compositions show different EMI-SE values (varies from 52 to 100). This may be due to the orientation of domains remained perpendicular to the direction of wave propagation.

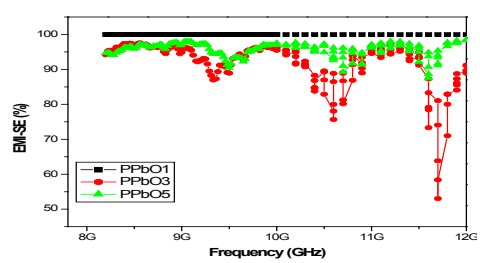

Figure 3 Shows the Variation of EMI-SE Vs frequencies (PANI / PbO)

IV. CONCLUSIONS

In this paper microwave absorption properties (EMI-SE in %) of PANI-PbO composites in the X-band frequency range have been presented. Our results clearly demonstrate that conducting PANI composite with PbO show better return loss and shielding properties (maximum EMI-SE is observed in 10 wt% of PbO in PANI). These composites may be used in the applications of Electromagnetic compatibility (EMC).

REFERENCES

[1] V.J. Chen, M.S. Cao, T.H. Wang and Q Wan, "Microwave absorption properties of the ZnO | nanowire-polyester composite" Applied Physics Letter, V84, pp. 3367, 2004 | [2.] .P Hus, "Electromagnetic interference", Tze-Chiang Foundation of Science and technology | Conference, Taiwan, pp 1-20, 1984 | [3] S.S Tzeng and F Y .Chang , Mater Sci Eng A, 302 p. 258, 2001 | [4] R.P. Pant, Chemical Co-precipitation, unpublished | [5] R.P. Pant, Rashmi, R.M. Krishna, P.S. Negi, K.Ravat, U. Dhawan , S.K. Dhawan, D.K. Suri , | J. Magn. Mater, V149, pp. 10, 1995.