Microwave Absorption (return loss) property study on Cadmium oxide (CdO) doped Polyaniline composite

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Abstract: Conducting polymers (Polyaniline) has received much attention because of its unique reversible proton doping, high electrical conductivity and low cost. Conducting polymer Composites are required in many engineering applications, especially electromagnetic compatibility. The polyaniline and its composites are synthesized by chemical oxidative polymerization method with dispersion of Cadmium oxide (CdO) in different weight percent. The microwave properties such as *return loss of all the composites in the frequency range 8-12 GHz is studies in this paper.*

Key Words: Polyaniline, Composites, Electromagnetic, microwave

1. 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 [1-3]. 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 [2-6]. Composites such as metal particles, metal flakes, carbon particles, carbon fibers are extensively employed in electromagnetic interference (EMI) shielding [3-7], we have synthesized conducting polymer composite with a CdO[12-13]. The present investigation deals with the return loss of the polyaniline composites at X band microwave region (8-12.6 GHz).

2. Materials and Method of Synthesis:

Aniline, hydrochloric acid (HCL) and ammonium persulfate [$(NH_4)_2S_2O_8$] of analytic grade are used for synthesis of polyaniline and Cadmium oxide was used to prepare composite via chemical oxidative polymerization method.

2.1 Preparation of Pure Polyaniline:

Aniline of 0.1M was dissolved in 1M HCl to form aniline hydrochloride. To this above solution, ammonium persulphate [$(NH4)_2S_2O_8$] of 0.1M was added slowly with continuous stirring for 4 – 6 hours at room temperature. The precipitated powder was vacuum filtered and washed with de-ionized water. Finally the resultant precipitate was dried in an oven for 24 hours to achieve a constant weight. The dried sample is crushed into fine powder in an agate mortar in the presence of acetone medium.

2.2 Preparation of PANI-CoO composite:

Aniline of 0.1M was dissolved in 1M HCl to form aniline hydrochloride. To this above solution, the Cobalt oxide is added in the different weight percent of 10, 20, 30, 40 and 50 wt% with vigorous stirring in order to keep the Cadmium oxide (CdO) suspended in the solution. To this reaction mixture, 0.1 M of ammonium persulphate [$(NH4)_2S_2O_8$] which acts as the oxidant was added slowly with continuous stirring

for 4 – 6 hours at room temperature. The precipitated powder was vacuum 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 5 different polyaniline - Cadmium oxide (CdO) composites with different wt % of cobalt oxide (10, 20, 30, 40 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.

2.3 Preparation of Pellets

The powders of Polyaniline, Polyaniline/ CdO composites, so obtained from synthesis techniques discussed in early sections were crushed and finely ground in agate mortar in the presence of acetone medium. The powder is then pressed to form pellets of 10 mm diameter and thickness varying up to 2 mm by applying pressure of 90 MPa in a hydraulic pressure. For temperature dependent conductivity studies, a silver paste was coated on both sides of surface of the pellet for providing electrical contacts.

3. Results and Discussions:

Figure-1 shows the variation of return loss with frequency for the composites 10-50 weight percent in polyaniline in the frequency range 8 to 12 GHz [8-15]. These composite shows decrease in return loss value in multiple band form with increase in the frequency and also observed that the 10wt% of Cadmium oxide in PANI shows maximum return loss and observed that the return loss increases with the decrease of Cadmium oxide in PANI this may be due to resonance [6-12]. Return loss RL (in decibel, dB) is obtained by

$$RL = 20 \log [(Zin - Zo) (Zin + Zo)]\ldots$$

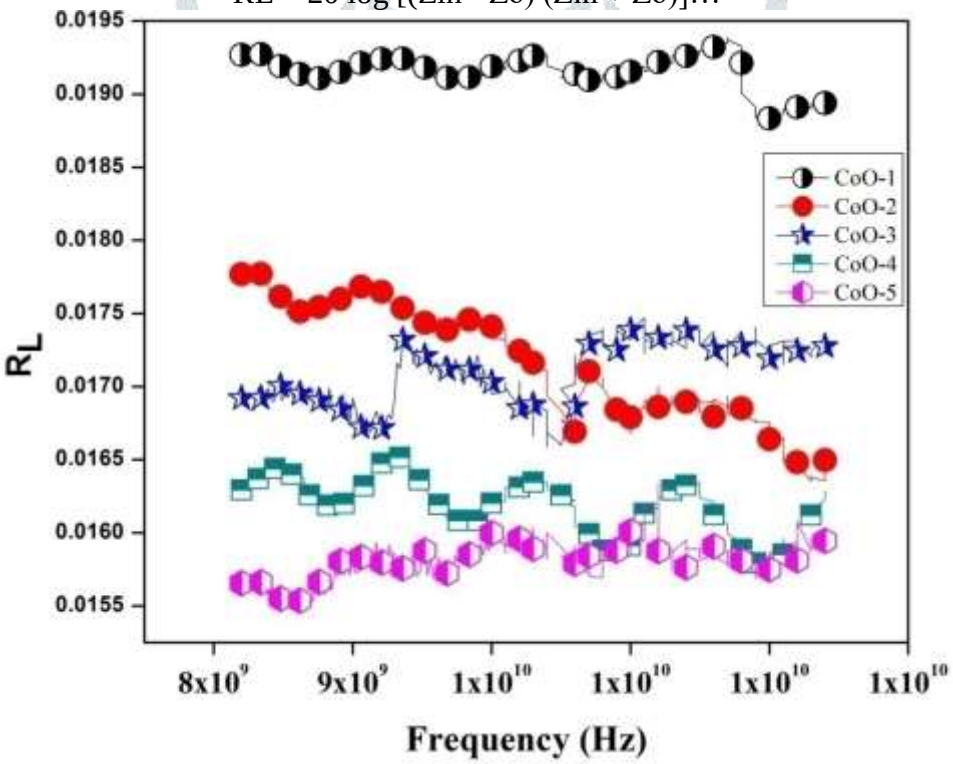

Figure-1: Variation of return loss spectra at X-band frequency

4. Conclusions:

In this paper, microwave absorption properties (Return loss) of PANI- Cadmium oxide composites in the X-band frequency range have been presented[9-13]. Our results clearly demonstrate that conducting PANI composite with Cadmium oxide show better return loss and observed that 10 wt% in PANI shows maximum return loss. These composites may be used for electromagnetic compatibility (EMC) applications.

5. References:

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