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Thermal and Sensing Properties Polyaniline/ Lead Oxide Nanocomposites

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ABSTRACT
Polyaniline/lead oxide Nanocomposites were synthesized by in-situ polymerization methods. The prepared nanocomposites were characterized by Transmission electron microscope (TEM) and Thermo Gravimetric analysis (TGA). The sensing properties of the samples wereinvestigated. It was found that increasing the concentration of lead oxide particles increases the sensitivity due to the hopping of polarons and extended chain length of composites. Among all the nanocomposites,50wt% showed highest sensitivity and these composites are useful in potential applications.

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I. INTRODUCTION

With the discovery in 1960 of intrinsically conducting polymers (ICPs), an attractive subject of research was initiated because of the interesting properties and numerous application possibilities of ICPs.[1-4] Conductive polymers have various applications such as rechargeable batteries , electromagnetic interferences (EMI) shielding , antistatic coatings, gas sensors, optical devices, removal of heavy metal from water and waste water , etc. Among conducting polymers, Polyaniline (PANI) is probably the most widely studied due to its several unique properties.[5-7] Its ease of preparation, light weight, low cost, better electronic, optical properties, highly stable in air and soluble in various solvents, and good processability.[8] On the other hand it can be used in many applications, such as electromagnetic interference (EMI) shielding, electro-catalysts, rechargeable battery, light-emitting diodes (LEDs), chemical sensor, biosensor, corrosion devices and microwave absorption . PANI exhibits dramatic changes in its electronic structure and physical properties at protonated state. Now days, polymer-inorganic hybrid nanocomposites have been receiving extensive attention due to their innumerable applications in various fields the translucent conducting materials of the type zinc oxide (ZnO) and titanium dioxide (TiO_2) have advantages of non-toxicity, low price, chemical sustainability and feasibility[6-7] of them being doped with variety of ions.[9-12]

II. EXPERIMENTAL

2.1 Synthesis of conducting Polymer

The synthesis ofPolyaniline (PANI) was based on mixing aqueous solution of aniline hydrochloride and ammonium persulphate at room temperature, followed by the separation of PANI hydrochloride precipitate by filtration and drying. An equimolar volume of aniline and hydrochloride acid was dissolved in distilled water in a volumetric flask to obtain 100 ml of solution. Similarly, ammoniumpersulphate (0.6M) was dissolved in 100 ml water. Both solutions were kept for 1 hour at room temperature and then mixed in a beaker, stirred with a mechanical stirrer and allowed to polymerize. After a day, the PANI precipitate was collected on a filter, washed with 0.3 M HCL and acetone repeatedly. The Polyaniline hydrochloride powder was then dried in vacuum at 60^{o}C for 24 hours.

2.2 Synthesis of Polyaniline/Lead oxide nanocomposites

Synthesis of Polyaniline–Lead oxide nanocomposites were carried out by in-situ polymerization method. Aniline (0.3 M) was mixed in 0.3 M HCl and stirred for 15 min to form aniline hydrochloride. Lead oxide powder was added in the mass fraction to the above solution with vigorous

stirring in order to keep the lead oxide homogeneously suspended in the solution. To this solution, 0.6 M of ammonium per-sulphate, which acts as an oxidizer was slowly added drop-wise with continuous stirring at ice temperature for 4 hours to completely polymerize. The precipitate was filtered, washed with deionized water and acetone, and finally dried in an oven for 24 hours to achieve a constant mass. The Polyaniline - lead oxide nanocomposites were thus obtained containing various weight percentage of nickel oxide (i.e.10, 20, 30, 40, & 50%).

2.3 Preparation of Pellets

The powders of Polyaniline, Polyaniline/PbO nanocomposites, so obtained from synthesis method discussed in earlier sections was made as a fine powder with the help of 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 1.8mm by applying pressure of 80 MPa in a hydraulic pressure. Then the pellets were coated with silver paste on both faces of the pellet for providing electrical contacts.

III. CHARACTERIZATIONS

3.1 Transmission electron microscope

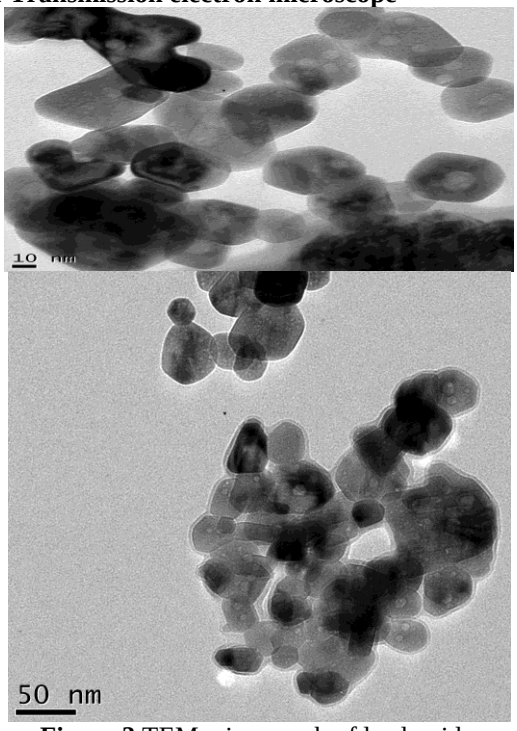

Figure 3 TEM micrograph of lead oxide nanoparticles

Figure 3 Shows the TEM micrograph of lead oxide nanoparticles. The average diameter of PANI/lead oxide nanoparticle which was synthesized using chemical oxidation technique is 50nm.The particle size of lead oxide nanoparticle is 10nm.

IV. RESULT AND DISCUSSION

4.1 Thermo Gravimetric analysis

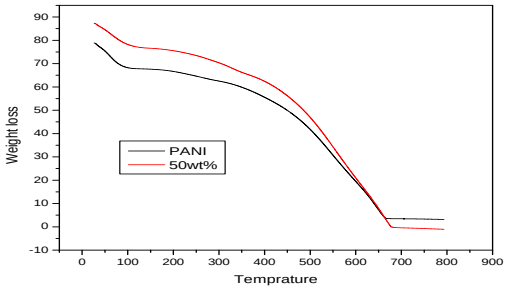

Fig 4.1TGA analysis for pure PANI and PANI/Lead oxide nanocomposites

The results of TGA analysis for pure PANI and PANI/Lead oxide nanocomposites are shown in Fig.4.1. In the TGA thermograph of PANI/PBO, it can be observed that the losses of weight occurred around two temperature periods, ranging from 30^{0}C to 150 ^{0}C and around 400^{0}C to600 ^{0}C. The first weight loss was mainly contributed by the elimination of impurities, residual water and unreacted monomers. The second step weight loss is due to the degradation of the polymer main chain.

4.2 Sensing studies

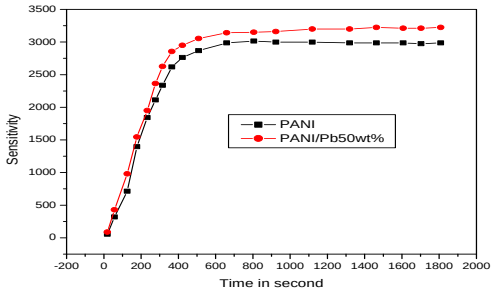

Figure4.2 sensitivity graph of Polyaniline and its nanocomposites

Figure4.2 shows the sensitivity graph of Polyaniline and its nanocomposites.The variation in the Sensitivity of the composites could be due the following reason. The LPG molecules induced and trapped into polymer matrix might cause it to swell leading to the disruption of conducting paths through

the composites. This results in increased Sensitivity of composites. Among all the nanocomposites,50 wt% showed highest sensitivity.

V. CONCLUSIONS

Polyaniline lead oxide nanocomposites have been synthesized via chemical oxidation technique. The average size of the nanocomposites is estimated to be 50 nm as observed in the TEM micrograph. The thermal stability for the nanocomposites has been improved as major mass losses occurred at higher decomposition temperature as compared to the pure polymer in the TGA profile. In the case of sensing studies 50wt% showed highest sensitivity .

REFERENCES

[1]. Epstein, A.J. and A.G. MacDiarmid, 1995. Polyanilines: From solitons to polymer metal, from chemical currosity to technology. Synth. Met., 69(1-3): 179-182.

[2]. Ohtani, A., M. Abe, M. Ezoe, T. Doi, T. Miyata and A. Miyke, 1993. Synthesis and properties of high-molecular-weight soluble polyaniline and its application to the 4MB-capacity barium ferrite floppy disk's antistatic coating.Synth. Met., 57(11): 3696-3701.

[3]. Matsuguchi, M., J. Io, G. Sugiyama and Y. Sakai, 2002. Effect of NH3 gas on the electrical conductivity of polyaniline blend films. Synth. Met., 128(1): 15-19.

[4]. Falco, E.H. and W.M. De Azevedo, 2002. Polyaniline-polyvinyl alcohol composite as an optical recording material, Synth. Met., 128(2): 149-154.

[5]. Eisazadeh, H., 2007. Removal of Chromium from waste water using polyaniline. J. Appl. Polym. Scie, 104(1): 1964-1967.e explored because of a number of obstacles that need to be overcome.

[6]. A.G. MacDiarmid, A.J. Epstein, Synthetic Metals 69 (1995) 86-92.

[7]. J.C. Aphesteguy, S.E. Jacobo, Physica B 354 (2004) 224–227.

[8]. A. B. Moghaddam, T. Nazari, Int. J. Electrochem. Sci., 3(2008)768-776 11. A. S. Sarac* , M. Ates and B. Kilic, Int. J. Electrochem. Sci., 3(2008)777-786

[9]. Synthesis, conductivity and sensitivity studies of Polyaniline – iron oxide nanocomposites .. Ferroelectrics 2016, vol. 505, 229–235.

[10]. Synthesis, characterization of polyaniline/ lead oxide nanocomposites and their electrical, sensing studies.ElsevierMaterials today: proceedings 3 (2016) 3844–3849.

[11]. .Syed AbusaleMhamadNabirqudri, Aashis.S.Roy, M.V.N. Ambika Prasad , Synthesis , Characterization and thermal properties of free standing polystyrene-ABS blends, Deccan journal of chemistry vol4(Issue-2015).

[12]. Electrical and magnetic properties of Polyaniline ni–zn ferrite nanocomposites journal of advanced physicsVol. 6, pp. 1–5, 2016

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