Available online at www.sciencedirect.com

ScienceDirect

Materials Today: Proceedings 3 (2016) 3844–3849

www.materialstoday.com/proceedings

ICMRA 2016

Synthesis, Characterization of Polyaniline/ Lead oxide Nanocomposites and their Electrical, Sensing studies

Dr.Jakeer Husain[a], Dr. Anwarulla [b], Dr.J.Sasi Kiran [c],Dr.Rahena Anjum[d], Narsappa Reddy[e], Syed Aslam[f], Jai Sagar[g],Bushara Anjum[h]

a Associate Professor in S&H,Farah Institute of Engineering ,Chevella,501503,JNTUH,Telangana ,India,
b Professor in Mechanical, Farah Institute of Engineering ,Chevella,JNTUH,Telangana
c Professor in CSE, Farah Institute of Engineering ,Chevella,JNTUH, Telangana,India,
d Professor in S&H, Farah Institute of Engineering ,Chevella,JNTUH,Telangana,India
e Associate Professor in ECM, JB Institute of Engineering & Technology, Moinabad, JNTUH,Telangana ,India,
f Associate Professor in Mechanical ,Farah Institute of Engineering ,Chevella,JNTUH, Telangana ,India,
g Assistant Professor in Mechanical, Farah Institute of Engineering,Chevella,JNTUH, Telangana,India ,
h Student Department of Physics Gulbarga University Gulbarga ,585106,,Karnataka,India,

Abstract

Lead oxide Polyaniline/nanocomposites were synthesized by In-situ polymerization Technique. The formation of Polyaniline/Lead oxide nanocomposites was characterized by XRD, SEM &TEM. The XRD patterns indicate the crystallite size of PbO as 50 nm. The dc conductivity of the samples was measured as a function of temperature in the range 30-180 ^{0}C and it was found that the increasing the concentration of PbO nanoparticles increases the conductivity and also the performance of a room temperature (30 ^{0}C) LPG gas sensor based on Polyaniline/Lead oxide nanocomposites were studied.

Selection and Peer-review under responsibility of International conference on materials research and applications-2016.

Keywords: **Polyaniline, Nanocomposites, XRD, TEM, SEM, DC conductivity, Sensitivity**

***Author of Correspondence: Dr.**Jakeer Husain
Email id:jakeerhusain21@gmail.com
Phone: +918861157762

Selection and Peer-review under responsibility of International conference on materials research and applications-2016.

1. Introduction

Conducting polymers provide great scope for change of their electrical conductivity from semiconducting to metallic region by way of doping and are organic electro chromic materials with chemically active surface. But they are chemically very sensitive and have poor mechanical properties and thus possessing a processibility problem. Nanomaterial, shows the presence of more sites for surface reactivity and they also possess good mechanical properties.Thus nanocomposites formed by combining conducting polymers & inorganic oxides nanoparticles, possess the good properties of both the constituents & thus enhanced their utility. The properties of such type of nanocomposites are strongly dependent on concentration of nanomaterials to be added. Among the organic conducting polymers polyaniline (polyaniline) is the only conducting polymer whose properties not only depend on the oxidation state but also on it protonation state / doping level and also on the nature of dopants. It possesses excellent properties such as its ease to synthesis , low density, less cost, better electronic, optical properties. It is generally regarded as one of the conducting polymer with high potential in commercial applications [1-3].It is therefore expected that this type of materials will play increasingly important roles in research and in numerous applications such as light emitting diodes, chemical materials, biosensors, rechargeable batteries and photovoltaic cells.They frequently have special properties and are significant for many technological applications, ranging from microelectronics to catalysis, optoelectronic devices, and synthesis of lubricant and preparation of electrolytes for rechargeable batteries [4-8]. The sensing mechanism of the reducing gases consists in the change of the electrical resistance resulting from chemical reaction between the gas molecules and adsorbed oxygen on the metal oxide surface [9-16]. In the present paper, authors report the synthesis, characterizations, and effects of PbO nanoparticles in Polyaniline/nanocomposites on Electrical and Sensing properties.

2. Experimental Method

2.1 Synthesis of Lead Oxide nanoparticles:

Lead Oxide (PbO) semiconductor nanoparticles were prepared by Chemical synthesis method. 60 ml of 1.0 M $Pb(C_2H_3O_2)_2.3\ H_2O$ (lead (II) acetate) aqueous solution was prepared using de-ionized water and heated upto 90 ^oC. This solution was added to an aqueous solution of 50 ml of 19M NaOH in a beaker and stirred vigorously. Upon adding the lead (II) acetate, the solution initially became cloudy, and then turned a peach colour, and finally a deep orange red. At this position, stirring was stopped, and the precipitate was allowed to settle. The supernatant was then decanted, filtered on a Buchner funnel, washed with de-ionized water repeatedly, and dried for overnight in a drying oven at 90 ^oC. The sample was then removed and lightly crushed in a mortar and pestle and finally calcinated for 3 hours to remove impurities.

2.2 Preparation of Polyaniline/PbOnanocomposites

Synthesis of the PANI– PbO nanocomposites was carried out by in-situ polymerization method. Aniline (0.1 M) was mixed in 1 M HCl and stirred for 15 min to form aniline hydrochloride. PbO nanoparticles were added in the mass fraction to the above solution with vigorous stirring in order to keep the PbO homogeneously suspended in the solution. To this solution , 0.1 M of ammonium persulphate, which acts as an oxidizer was slowly added drop-wise with continuous stirring at 5^0C for 4 h to completely polymerize. The precipitate was filtered, washed with deionized water, Acetone, and finally dried in an oven for 24 h to achieve a constant mass. In these way, PANI– PbO nanocomposites containing various weight percentage of PbO (10 %, 20 %, 30 %, 40 %, and 50 %) wt% in PANI were synthesized.

3 Characterization :

X-ray diffraction studies were performed using Philips X-ray diffractometer with CuK_α as the radiation source. The morphology of the nanocomposites in the form of powder was investigated using scanning electron microscope (SEM) Model-EVO-18 (Special Edison, Zeiss, Germany). DC conductivity of these nanocomposites are studied by using Keithley 6514 electrometer, sensing properties of these nanocomposites were studied using laboratory set up.