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ORIGINAL PAPER

Synthesis, characterisation, and DC conductivity of polyaniline–lead oxide composites

[a]Ameena Parveen, [b]Raghunandan Dashpande, [c]Shakeel Ahmed, [d]Aashis S. Roy*

[a]*Department of Physics, Government First Grade College, Gurmitkal, Yadgir-585214, Karnataka, India*

[b]*Department of Pharmaceutical Chemistry, H.K.E. Society's Matoshree Taradevi Institute of Pharmaceutical Sciences, Gulbarga-585104, Karnataka, India*

[c]*Department of Physics, Government First Grade College, Bhalki, Bidar-585401, Karnataka, India*

[d]*Materials Engineering Department, Indian Institute of Science, Bangalore-560012, Karnataka, India*

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The polyaniline–PbO composites of various mass fractions were prepared by in situ polymerisation. The prepared samples were characterised by FTIR, and the dominant peaks confirmed the formation of polyaniline–PbO composites. The SEM study shows a granular agglomerated morphology, and increases with an increase in the lead oxide mass % in polyaniline. Direct current (DC) conductivity (σ_{DC}) was studied as a function of temperature (T). From these studies, it was found that conductivity increased at higher temperatures due to the polarons hopping from one localised state to another. DSC studies reveal, the decrease in peak temperature from 273 °C (pure PANI) to 169.2 °C, 193.5 °C, 218.4 °C, 235.2 °C, and 224.2 °C, respectively for the various mass fractions (10 %, 30 %, 20 %, 40 %, and 50 %) of polyaniline–PbO composites.

Keywords: polyaniline, lead oxide, DC conductivity, DSC, SEM

Introduction

Organic–inorganic composites with a controlled structure have been the subject of extensive study because these hybrid materials bring new properties of both initially organic as well as inorganic materials (Wu et al., 1996; Kerr et al., 1996; Kim et al., 2007; Chakraborty et al., 2011; Li et al., 2012). Out of all the conducting polymers, polyaniline (PANI) is one of the conducting polymers most extensively studied due to its easy synthesis, low cost, tunable conductivity, and environmental stability (Bae et al., 2004). As a consequence, PANI has attracted considerable interest in the preparation of composites by incorporating inorganic particles such as $BaTiO_3$ (Li et al., 2008), molybdenum trisulphide (Somani et al., 1999), V_2O_5 (Anilkumar et al., 2009), inorganic salts (Patil et al., 2011) and montmorillonite, ZrO_2 (Li et al., 2010) etc. PANI–metal oxide composites have been studied for various applications such as sensors, battery electrolytes, microwave applications, solar materials, and in high density information storage devices (Jia et al., 2002; Su & Kuramoto, 2000). The combination of conducting polymers with a host of foreign inorganic materials having different characteristics opens new prospects for developing hybrid materials with interesting properties (Wang et al., 2006).

In our earlier paper (Roy et al., 2011c), we reported that the nanostructured-PANI–CdO composites could be used as LPG sensors. When PANI–CdO composites are exposed to LPG, they interact with the LPG due to the adsorption–desorption phenomenon. The reduction reaction takes place only on the sur-

*Corresponding author, e-mail: aashis_roy@rediffmail.com