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A Study on Structural, Electrical and Thermal Properties of Polyaniline Nanofiber–Silica Nanocomposite

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ABSTRACT

Polyaniline/silica composites have received growing attention during past two decades. In the present worknanosilica is synthesized from plant source rice husk and is modified by 3-aminopropyl triethoxy silane. A new modified interfacial polymerisation method for the synthesis of polyaniline nanofiber – silica nanocomposite has been developed. This in-situ polymerization was carried out in an aqueous/organic interface. Also the influence of the synthetic route and amounts of nanocellulose on the structure, morphology, and properties of the as-synthesized nanocomposite were investigated. These nanocomposites were characterized by scanning electron microscopy (SEM), thermogravimetric analysis and Conductivity measurements. The electrical conductivity of polyaniline nanofibers/silica nanocomposites is in the range 3.08-4.23 Scm^{-1}. The surface morphology from SEM analysis reveals that there will be uniform distribution of silica nanospheres in the network of polyaniline nanofibers. Thermogravimetric analysis of the nanocomposites suggested that thermal stability increases by the addition of nanosilica.

KEYWORDS: *polyaniline, nanofiber, nanocomposites, interfacial polymerisation.*

INTRODUCTION

During past two decades, conducting polymersand its nanocompositeshave attracted great research interest as an important class of materials in the area of nanotechnology. The polyaniline (PANI) and its composites are one of the most studied conducting polymer materials owing to their electrochromicand photoconductivity properties allied with their higher stabilityin air and easier doping process, as compared to other conductingpolymers.[1]. Nanostructures of polyaniline such as nanofibers, having physical and chemical properties differing from their bulk counterparts and have potential applications including chemical sensors [2] and electromagnetic shielding devices [3].Recently composites of polyaniline with various metal-oxides, inorganic, organic, nanoparticles have been synthesized and properties of polyaniline have improved significantly. Fabrication of polyaniline nanofiber-nanosilica nanocompositeopens new routesfordeveloping new generation of conducting organic–inorganic hybrid materials, since they should combine their physical and chemical properties at the nanometer scale, such as thermal resistance and mechanical strength etc. In this study, we developed a modified interfacial polymerisation method for the synthesis of polyaniline nanofiber – silica nanocomposite and characterized using a wide range of experimental techniques includingby scanning electron microscopy (SEM), thermogravimetric analysis and Conductivity measurements.

EXPERIMENTAL

Materials

For the preparation of nanosilica Rice husk was collected from a local mill in Kalady, Kerala, India. Aniline (99.5%), ammonium peroxy disulfate (98%), D(+)-10-camphorsulfonic acid (99%), cetyl trimethyl ammonium bromide, (CTAB), aqueous sodium hypochlorite (4% by wt) solution (NaOCl),carbon tetrachloride(CCl_4),HCl(35-38%) , NaOH(97%), toluene(99%), 3-aminopropyl triethoxysilane(98%) are used. They were purchased from Spectrochem Pvt. Ltd. Mumbai, India. Aniline was distilled and stored at 4^0C prior to usage.