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Preparation and Characterisation of Pani Nanofibres Using Ferric Chloride As Oxidant in Presence of Hcl

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Abstract--- *To prepare polyaniline (PANI) nanofibers by using FeCl3·6H2Oas the oxidant in the presence of inorganic acids HCl without any external template and to characterize it.*

Keywords--- *Preparation and Characterisation, Presence of HCL, Nanofibres.*

I. INTRODUCTION

Polyaniline (PANI) is a unique conjugated polymer, which has been widely studied for electronic and optical applications. PANI nanowires (nanotubes or nanofibers) have recently received considerable attention since such materials are expected to play an important role in optoelectronic nano-devices, ranging from single-molecular transistor to chemical nano-sensors or artificial actuators. Kaner and co-workers recently reported resistive-type sensors made fromun-doped or doped PANI nanofibers outperforming conventional PANI film on exposure to acid or base vapours, respectively. In principle, PANI nanotubes or nanofibers can be synthesized by template-guided polymerization or physical technique of electro-spinning and mechanical stretching. The used templates are either “hard” or insoluble solid membrane such as anodized alumina and zeolite channels or “soft” structural molecules such as surfactant. Wan and co-workers created a “template-free” method to prepare PANI nanostructures, where micelles composed of dopant or dopant/monomer salts act as the “soft-template” in the formation of the PANI micro/nanostructures. “template-free” method is a simple, universal and controllable approach to prepare PANI nano-structures.the electrical properties of single nano-wire or nano-tube of conducting polymers have recently received considerable attention because of playing an important role in understanding conducting mechanism of conducting polymers and fabrication of the nano-devices. Martin reported that the conductivity of the PANI nanotubes prepared by template-synthesis method increases with the decrease of the diameter, showing a size effect on the conductivity. Herein the self-assembled PANI nanofibers doped with inorganic acids HCl was successfully prepared by template-free method in the presence of FeCl3·6H2O as the oxidant. Characterization of the sample is done.

II. MATERIALS

Aniline monomer was distilled under reduced pressure HCl as the dopant and ferric chloride (FeCl3·6H2O) as the oxidant as well as other reagent were used as-received without further treated.

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III. PREPARATION

HCl doped PANI nanofibers were prepared by template free method using FeCl3·6H2O as an oxidant. Typical preparation process is as follows: 0.2mL aniline and a quantity of inorganic acids were dissolved in 10mL de-ionized water to form uniform solution under magnetic stirring in the ice-bath (0–5 ◦C) for 30min. FeCl3·6H2O (2.4 mol L−1) aqueous solution was added to the above solution and which was kept silent for 16 h to produce a dark-green powder. The resulting PANI precipitate was washed with water, methanol and ether several times, respectively. Finally, the product was dried at room temperature for 24 h. Three different molar ratios of FeCl3·6H2O to aniline represented by [FeCl3]/[An] ratio of 8:1, 12:1 and 16:1 were used for searching the optimal formation conditions to prepare the nanofibers doped with HCl by using FeCl3·6H2O as an oxidant.

IV. SELF ASSEMBLY MECHANISM OF NANOFIBRES

Micelles composed of dopant/aniline salt are regarded as the “soft-templates” in formation of the PANI nanofibers oxidized by FeCl3 as the oxidant.The polymerization took place only at the micelle/water interface because of the hydrophilic of the FeCl3, and the growth of the nanofibers is allowed by accretion and/or elongation process.The diameter of the nanofibers is mainly controlled by the redox potential of FeCl3 as the oxidant.

The redox potential of FeCl3 (0.77V) is lower thanthat of APS (2.0 V) [23] so that the diameter of the nanofibers oxidized by FeCl3 thinner than that of the nanofibers oxidized by APS is expected

V. CHARACTERIZATION

Infrared spectra of the PANI–HCl nanofibers synthesized at different [FeCl3]/[An] are obtained(by mixing the sample with KBr) using the FTIR spectrometer available at SAIF,IIT,Madras.By dissolving the samples with m-cresol,UV vis absorbtion spectrum are obtained by using UV spectrometer available at SAIF,IIT,Madras. Morphologies of the resulting PANI were measured with a emission scanning electron microscope (SEM) available at SAIF,IIT,Madras. The room temperature conductivity of compressed PANI pellets was measured by using Multi-meter.

VI. CONCLUSION

PANI nanofibers were successfully prepared by using FeCl3 as the oxidant in the presence of inorganic acids HCl. It is found that low redox potential of FeCl3 results in thin nanofibers,. The result obtained by us almost matches with the result obtained by Zhiming Zhang and Co.It has been demonstrated that FeCl3 is an excellent oxidant to prepare really nano-scaled fibbers or tubes of PANI and its derivatives via a self-assembly process.

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