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SYNTHESIS AND CHARACTERIZATION OF A NOVEL NANOCOMPOSITE POLYMER

One-dimensional nanostructures of PANI: PVA-g-EI nanocomposite are prepared by the interfacial polymerization method. The properties of a resulting green powder are studied by the X-ray diffraction (XRD), energy-dispersive X-ray analysis (EDX), transmission electron microscopy (TEM), and infrared spectroscopy (FTIR). Prepared thin films were characterized by UV-Vis and photoluminescence (PL) spectroscopies. The XRD pattern of the nanocomposite shows that the higher volume fraction of crystalline phases corresponds to the PANI polymer with the accepted monoclinic unit cell of PVA. Nano-sized irregular particles arranged in clusters appear in the TEM measurements and SEM images, which testifies to the agglomeration without uniform packing. EDX confirms that the PVA-g-EI is incorporated in the structure of the polymer nanocomposite. A significant shift in the absorption edge with three PL independent emission peaks again confirms that PANI/PVA-g-EI form a nanocomposite.

Keywords: nanocomposite, thin films, polyaniline, dye, PVA.

1. Introduction

In the last decade, we have observed the increased interest in conjugated polymers which have π-electrons. This causes the electron to be delocalized along the polymer backbone, and this results in that the charge carriers will move along the polymer chain. The metallic or semiconducting properties of these polymers are therefore specified by the electronic construction, the number of repeated units being one example of this [1, 2]. Some of these polymers are the conductors which have been used in the optical devices, electroluminescent and photovoltaic devices, and as photoactive materials [3, 4]. Polyaniline (PANI) is one of the conductive polymers which were discovered in the latter half of the 19th century which have drawn the increased attention due to a tunable property, good stability, synthesis simplicity, and low cost. This broadens their application to various fields such as light-emitting and electronic devices, biosensors, and energy storage units [5–8]. However, the poor process ability of polyaniline due to the insolubility in common organic solvents and the poor mechanical properties restrict the potential applications of PANI [9]. Attempts have been made to improve the solubility of conducting polymers and, thus, their processability and to increase the film quality by using PVA polymer to composite it with polyaniline. In fact, composite films could preserve their conductivity even under the humidity or at the heating [10]. Several methods have been used in the preparation of PANI /PVA composite [11, 12].

The visible spectral response of polyaniline is limited to a narrow range. So, with a view to improve and extend the parameters of conducting polymers to a wider region of the spectrum, dyes have to be

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