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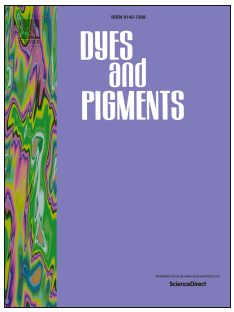

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Photophysical Properties of Phosphorescent Elastomeric Composite Nanofibers

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Abstract

Phosphorescent elastomeric nanofibers were successfully prepared via electrospinning technique. Thermoplastic polyurethane (TPU) was used as carrier polymer, where copper doped zinc sulfide (ZnS:Cu) phosphorescent nanoparticles were incorporated at 0.5-2.0% concentrations. Scanning electron microscopy (SEM) analysis showed that particles were mostly embedded within TPU nanofibers. Average diameter of the neat TPU nanofibers was found to be around 246±100 nm, which nearly doubled for 2.0% ZnS:Cu/TPU nanofibers. Optical properties of the nanofibers were analyzed via fluorescent spectrofluorophotometer. Fluorescence emission maximums around 460, 490, 515 and 530 nm were assigned to TPU, whereas phosphorescent emission obtained at wavelength 515 nm was due to ZnS:Cu particles. Elastomeric nanofibers might be stretched up to 30% of their initial length without deforming web structure, which is thought to be important for practical textile applications. Interestingly stretching up to 20% resulted with increase in photoluminescence (PL) lifetime and intensity which might be due to lesser shielding by carrier polymer.

Keywords

Elastomeric nanofibers, phosphorescent, ZnS:Cu, persistent luminescence, electrospinning

1. Introduction

Zinc sulfide (ZnS), is one of the IIb-VIb wide band-gap semiconductor compounds with a direct band gap of 3.72 eV and 3.77 eV for cubic zinc blend (ZB) and hexagonal wurtzite (WZ) structures, respectively [1-2]. Compared to other chalcogenides such as ZnSe, ZnS is chemically stable which is important for long term photoluminescence (PL) applications [3]. Transition metal and rare earth ions have been incorporated into ZnS and according to dopant type and concentration, ZnS based phosphorescence materials may exhibit different optical properties. For example undoped ZnS shows blue emission, whereas