Development of Polydiacetylene/ZnO Nanocomposites for Electrochromic Application

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Polydiacetylene (PDA) is a well-known chromatic material which can change color by the conformation transition in response to various environmental stimuli. However, it is difficult to induce conformation changes of pure PDA under electric fields. Herein, we introduced ZnO nanorods as a nano-template which can provide efficient channels for electric current as well as large active surface area for PDA. The ZnO nanorod arrays were synthesized by using spin coat method to prepare a seed layer on a well-cleaned Indium doped Tin oxide (ITO) glass substrate and subsequently a hydrothermal process was employed to encourage the perpendicular growth of ZnO nanorods. The surface morphology and roughness of the films were examined using atomic force microscopy. X-ray diffraction (XRD) structural analysis revealed a preferential c-axis (002) orientated growth and images from scanning electron microscopy (SEM) showed uniformly dispersed hexagonal ZnO nanorods with an average diameter of ~ 42nm. After adsorption of 10,12-pentacosadiynoic acid onto the surface of ZnO nanorods, successful PDA formation was confirmed after photopolymerization exhibiting diameter increase of the composited nanorods to ~ 58nm. When the electric potential was applied, blue to red chromogenic response of PDA/ZnO nanocomposite was observed at low electrical potentials. Abrupt change of absorption was detected in (PDA)/ZnO nanocomposite system. The λ_{max} value initially detected at 646 nm shifted to about 550 nm, corresponding to the color transition from blue to red.