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Preparation, characterization and photocatalytic activity of a novel nanostructure ZnO composite film derived sol-gel process using organic binder materials

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ABSTRACT

A novel sol–gel-derived zinc oxide nanostructure has been prepared by spin-coating and investigated for the purpose of producing films. ZnO films were spin-coated on microscope glass slides via methylcellulose (MC) aided sol–gel route using zinc acetate–acetic acid–EtOH as starting materials and heat treatment. Scanning electron microscopy (SEM) investigations showed that relatively dense, crack-free and transparent ZnO composite films, as well as, a decrease in the size of the ZnO nanoparticles, were achieved via the MC assisted sol–gel and single-step deposition at room temperature. Fourier transform infrared spectroscopy (FTIR) and thermal gravimetry analysis (TGA) results demonstrated full decomposition of the organic materials after firing. Photocatalytic activity of the composite films were evaluated through the degradation of a textile dye, Acid Blue R (C.I. Acid Blue 92) as a model pollutant and were compared with those of similar composite film without MC. 2%MC/ZnO thin film showed an interesting decolorization performance, as denoted by an attenuation degree of 99% and decoloration rate, assuming an apparent first order reaction, reaching 9.8×10^{-2} min^{-1}.

Keywords: Decolorization; Sol–gel; Acid Blue R; Nanostructure; ZnO composite film; Methylcellulose

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