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The influence of vanadium pentoxide on the structure and dielectric properties of poly(vinyl alcohol)
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King Abdul Aziz University, Physics Department, Jeddah, Saudi Arabia

Abstract
Polymers containing metal oxides of nanoscale dimensions have attracted attention because of their unique properties and new findings concerning technological applications. Polymers containing vanadium pentoxide (V2O5) have attracted our interest in respect of their potential applications in memory and switching devices. Poly(vinyl alcohol) (PVA) containing different concentrations of V2O5 ranging from 0 to 0.5 wt% were prepared. The synthesized PVA/V2O5 composites were cast as self-standing flexible films. The composites were characterized using X-ray diffraction (XRD) and Fourier transform infrared (FTIR) spectroscopy. An attempt was made to study the relaxation characteristics of PVA/V2O5 samples. The permittivity and dielectric loss were determined as a function of V2O5 concentration. The results show that the optimum concentration is 0.3 wt%. The electrical conductivity and dielectric modulus in the temperature range 303-433 K at various frequencies (10-100 kHz) for the optimum concentration were investigated. XRD and FTIR results show that the addition of V2O5 reduces the crystallinity of PVA due to the interaction of vanadium ions with the OH groups of PVA. The application of the dielectric modulus formulism gives a simple method for evaluating the activation energy of the dielectric relaxation. The frequency dependence of the electrical conductivity follows the Jonscher universal dynamic law. The conductivity in the direct regime is described by the small polaron model. The electrical conductivity and dielectric properties show that Hunt's model is well adapted to PVA/V2O5 films. © 2010 Society of Chemical Industry.

Author Keywords
Dielectric; Nanocomposite; Poly(vinyl alcohol) (PVA); Vanadium pentoxide (V2O5)

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