

# Effect of PVA and Copper Oxide Nanoparticles on the Structural, Optical and Electrical Properties of Carboxymethyl Cellulose Films

*Journal of Materials Science, volume 50, 2015, pp. 4717-4728*

A.M. El Sayed, S. El-Gamal, W.M. Morsi, Gh. Mohammed

## Abstract

Controlling the physical properties of the functional materials is required for broadening their industrials and technological applications. High purity CuO nanoparticles (NPs) of monoclinic phase and average crystallite size of 35 nm were prepared by a simple sol-gel technique. A solution casting method was applied to prepare carboxymethyl cellulose (CMC), polyvinyl alcohol (PVA)/CMC, and CuO/PVA/CMC nanocomposite films. XRD pattern of CMC shows a broad XRD peak around  $2\theta = 20.7^\circ$  which is influenced by PVA and CuO NPs addition. The surface morphology and dispersion of CuO NPs in PVA/CMC films were investigated by scanning electron microscopy (SEM). CMC film shows transparency of 87% increased after PVA addition and then decreases with CuO NPs incorporation. The insulating properties, refractive index and optical constants of CMC are controlled by mixing with PVA and doping with CuO NPs. In addition, the current-voltage (*I-V*) characteristics of the PVA/CMC blend and nanocomposite films show a non-ohmic behavior. The conduction mechanism in PVA/CMC blend is Schottky emission at low temperature. While, the Poole-Frenkel effect plays an important role in CuO doped films at high temperatures.

**Key words:** Nanocomposites; PVA/CMC; CuO; Optical constants; I-V Characteristics; Conduction mechanism.

\***Corresponding author:** ams06@fayoum.edu.eg & adel\_sayed\_2020@yahoo.com