Influence of Magnesium Content on the Structural, Optical, and Electrical Properties of Cu2 (Zn1-xMgx) SnS4 Nanostructured Quaternary Thin Film Synthesized Using the Sol–Gel Method

Nanostructured Cu 2 ZnSnS 4 (CZTS) and Cu 2 (Zn 1-x Mg x) SnS 4 quaternary alloys with varying magnesium (Mg) content were synthesized using a low-cost, environmentally friendly co-precipitation technique. The structural characteristics of Cu 2 (Zn 1-x Mg x) SnS 4/Si were analyzed using x-ray diffraction (XRD) and field-emission scanning electron microscopy (FE-SEM). The XRD results showed that the CZTS film crystallized the kesterite phase, whereas the Cu 2 MgSnS 4 film formed a stannite phase. Increases in Mg content led to an increase in the crystallinity of the deposited alloy, and to an increase in the average crystallite size from 31.65 nm to 53.73 nm. FE-SEM micrographs indicated the morphology of more densely packed nanostructures with less porosity when the Mg content was increased, resulting in the granular structure changing to a whisker-like form. Investigation into the optical properties of …