**Abstract**

Nanoparticles of the environmentally benign Cu-based quaternary chalcogenide compound Cu2FeSnS4 (CFTS) were successfully synthesized and the powder coated as a thin film on a FTO substrate by spin coating. The CFTS nanoparticles were prepared by a simple, low cost hydrothermal reaction method. The prepared samples were characterized by X-ray diffraction (XRD), Raman spectroscopy, UV-Vis spectroscopy and Field emission scanning electron microscopy with energy dispersive spectroscopy (FESEM – EDX). The results of the analyses confirm that the obtained nanoparticles are high crystalline with pure tetragonal structure. Morphological images show that the CFTS nanoparticles are closely packed with slight agglomeration. UV-Vis absorption spectrum revealed that the nanoparticles have a strong absorption band in the visible region with a band gap of 1.32 eV, which indicates their potential as promising materials for photovoltaic application. In the present study, the fabrication of CFTS based solar cells of layer configuration FTO/ZnO/CdS/CFTS has been reported. The fabricated solar cell was characterized by current- voltage (I-V) measurements under simulated AM 1.5 illumination.