VINGNANAM Research Conference

21st of July 2022

VRC–2022

Faculty of Science
University of Jaffna
Sri Lanka

Jointly Organized by

Faculty of Science
University of Jaffna
Sri Lanka

Western Norway University of Applied Sciences

Development and characterization of Mn-doped CuSCN hole transport material

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Pure and manganese (Mn)doped CuSCN thin-films were prepared by using dimethyl sulfoxide (DMSO) as the solvent via the doctor blade method, and their electrical, optical, and structural properties were characterized. Mn-doped CuSCN thin-films were prepared with Mn mass percentages as 2 %, 4 %, 6 %, 8 %, and 10 %. Structural and optical properties were characterized by using XRD and UV-Visible spectrometers. According to the sheet resistance value for the unit area of thin films, conductivity gradually increased with Mn concentration in samples up to the doping concentration of 6 % and this mass percentage of CuSCN sample exhibited the highest conductivity value. The calculated crystalline size for pure CuSCN is 70.7 nm and, 28.3 nm for the 10 % doped sample. It reveals that the crystalline size decreased with the increase of Mn concentration. All the Pure and Mn-doped CuSCN thin-films show the absorbance in the UV-Visible wavelength region of the spectrum. The calculated optical energy bandgap of CuSCN is 3.18 eV, and it exists within the semiconductor region and can be considered as a wide bandgap semiconductor. Hence, the Mn-doped CuSCN layer can be used as an efficient hole transport material (HTM) layer in dye-sensitized solar cells and other applications.

Keywords: *Copper thiocyanate, electrical conductivity, Manganese, optical bandgap.*