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FABRICATION AND CHARACTERIZATION OF ELECTROPHORETICALLY DEPOSITED WO₃ DYE SENSITIZED SOLAR CELLS

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ABSTRACT

WO₃nanospheres prepared by thermal evaporation of tungsten in oxygen atmosphere were deposited electrophoretically onto fluorine doped indium tin oxide (FTO) and quartz substrates for the fabrication of dye-sensitized solar cells (DSSC). SEM, TEM and XRD were used for microstructural characterization of the WO₃ thin film. The optical characterization was done by transmittance measurement at room temperature using an UV-VIS-NIR spectrophotometer. The transmittance measurements yield the various optical constants (n, k, d and E_g) of the WO₃ thin films. XPS measurement revealed the composition of the films. The WO₃ nanoparticles had a mean diameter of 225 nm with a typical Gaussian type distribution of nanosphere sizes having half width of about 130 nm.

The DSSC was fabricated using naturally found Henna (*Lawsonialnermis*) as the dye, which was loaded onto the WO₃ coated FTO substrate. The top electrode was another FTO substrate. The DSSC showed a short-circuit current of 5.1 mA and an open circuit voltage of 300 mV under standard test condition (AM1.5). The fill factor of the solar cell was calculated to be 0.57. The fill factor of the cell is constrained by the parasitic resistances, which incorporate the high series resistance of the cell, along with the contact resistances. For our DSSC, under standard test condition (STC), the conversion efficiency η was obtained to be about 0.89 %. The IPCE spectra displayed appreciable photo-response in the 300-700 nm range, with a maximum at about 450 nm.

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