

ENHANCING EFFICIENCY OF DYE-SENSITIZED SOLID-STATE SOLAR CELLS USING ALKYL-FUNCTIONALIZED ORGANIC DYE.

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Since mid-nineteen nineties, a number of attempts have been made in the field of Dye-sensitized Solid-state Solar Cells (DSSCs) which circumvent the problems associate in wet type Dye-sensitized Solar Cells (DSCs). However the photovoltaic efficiency is lower with compare to DSCs. When considering the configuration of DSSCs n-type semiconductor/dye/p-type semiconductor would lead to rise the recombination rate. The structure of the photosensitizer can effect for the photovoltaic performance as well as the recombination rate of the cell. Alkyl-Functionalized Organic dye namely MK-2, comprises Donor- π spacer- Acceptor morphology which can reduced the recombination rate by providing long distance for charge separation. MK-2 with volatile electrolyte and spiro-OMeAD were reported 8.3% and 2.8% conversion efficiency respectively. DSSC was prepared by using TiO₂ and CuI as n-type and p-type semiconductor respectively with adding Triethylamine thiocyanate as a crystal inhibitor and sensitized with MK-2 dissolved in acetonitrile / tert-butyl alcohol (1:1 volume ratio) and toluene. The optimum photovoltaic performance of DSSC sensitized by MK-2 dissolved in acetonitrile / tert-butyl alcohol, with 15 μm thickness of TiO₂ film have shown 0.496 V open circuit voltage, 16.14 mA cm⁻² current density, 0.42 fill factor with overall efficiency 3.33% under 1.5 AM illumination. The UV-visible and IPCE results have been shown MK-2 dye able to absorb board range in visible spectrum and more than 50% photons convert to electrical energy. As such, MK-2 dye would be suitable for sensitize DSSCs with CuI as a p-type hole conductor.

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Keywords: Alkyl-functionalized organic dye, Copper iodide, Donor- π spacer- acceptor, Dye-sensitized solid-state solar cells.