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Higher Efficiency for Quasi-Solid State Dye Sensitized Solar Cells Under Low Light Irradiance AJITH DESILVA, Department of Physics, University of West Georgia, T.M.W.J. BANDARA, H.D.N.S. FERNADO, P.S.L. FERNANDO, Department of Physics, University of Rajarata, Mihintale, Sri Lanka, M.A.K.L. DISSANAYAKE, Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka, W.J.M.J.S.R. JAYASUNDARA, Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka, M. FURLANI, B.-E. MELLANDER, Department of Applied Physics, Chalmers University of Technology, Gothenburg, Sweden — Dye-sensitized solar cells (DSSCs), lower cost solar energy conversion devices are alternative green energy source. The liquid based electrolyte DSSCs have higher efficiencies with many practical issues while the quasi-solid-state DSSCs resolve the key problems but efficiencies are relatively low. Polyacrylonitrile (PAN) based gel polymer electrolytes were fabricated as DSSCs by incorporating ethylene carbonate and propylene carbonate plasticizers and tetrapropylammonium iodide salt. A thin layer of electrolyte was sandwiched between the TiO2 anode (sensitized with N719 dye) and the Pt counter electrode. The electrolyte had an ionic conductivity of 2.6 mS/cm at 25 degrees of Celsius. DSSCs incorporating this gel electrolyte revealed Vsc circuit, Jsc, fill factor (FF) and efficiency values of 0.71 V, 11.8 mA, 51 percent and 4.2 percent respectively under 1 sun irradiation. The efficiency of the cell increased with decreasing solar irradiance achieving up to 10 percent efficiency and 80 percent FF at low irradiance values. This work uncovers that quasi-solid state DSSCs can reach efficiencies close to that of liquid electrolytes based cells.

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