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Poly (vinylidene fluoride-hexafluoropropylne) and fumed silica based nano-composite electrolyte for efficient dye sensitized solar cells

Weerasinghe A.M.J.S.[1,3*], DissanayakeM.A.K.L.[1], Senadeera G.K.R[1,2], Thotawatthage C.A[1,3] , Kumari J.M.K.W[1,3]

[1]*NationalInstitute of Fundamental Studies, Hanthana Road, Kandy, Sri Lanka.*
[2]*Department of Physics, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka*
[3]*Postgradutate Institute of Science, University of Peradeniya, Sri Lanka*

Dye sensitized solar cells (DSSC) are considered as most promising molecular photovoltaics and cheaper alternative to the conventional silicon based solar cells due to lower fabrication cost and abundance of materials. However, liquid electrolytes employed in most of the DSSC have several disadvantages such as lack of long term stability due to liquid leakage, electrode corrosion and photo decomposition of the medium. Quasi solid state (gel) electrolytes based on various polymers and gelators, can be used to overcome these drawbacks. In this study, it was used a gel electrolyte consisting of ethylene carbonate (EC), propylene carbonate (PC), poly (vinylidene fluoride-hexafluoropropylne) (PVdF-HFP) nanofiber, fumed silica, potassium iodide (KI), tetra propyl ammonium iodide (Pr_4NI), PMII ionic liquid, and 4-tert-Butylpyridine (TBP) in DSSCs. Nano fiber and fumed silica provide the structural stability for the gel electrolyte which entraps the liquid electrolyte and provides a higher efficiency in DSSCs compared to the conventional gel electrolyte based DSSCs. A short circuit photocurrent density of 13.8 mA cm^{-2}, an open circuit voltage of 699.2 mV, a fill factor of 66.9%, and an overall efficiency of 6.46% were observed under simulated sunlight of 100 mW cm^{-2} on a fabricated dye sensitized solar cell in configuration of FTO/TiO_2 electrode/ Ruthenium dye (N719)/ PVdF-HFP and fumed silica nanocomposite electrolyte/ Pt/ FTO.

Keywords: *Dye Sensitized Solar cells, Nano composite electrolytes*

*Corresponding Author: janith@ifs.ac.lk