

Acetonitrile free liquid electrolyte for dye-sensitized solar cells

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Dye-sensitized solar cells (DSSCs) are the third generation, low cost photo electrochemical cells in solar energy harvesting applications. DSSCs usually employ a liquid electrolyte based on acetonitrile and the iodide/triiodide (I^-/I_3^-) redox couple and have impressive energy conversion efficiencies. However, lack of durability due to liquid leakage, harmful solvent, electrode corrosion and photodecomposition of the dye in solvent medium due to usage of volatile liquids are some of the major drawbacks preventing large scale practical applications of liquid electrolyte based DSSCs. Therefore, in this study we have attempted to minimize above problems by replacing the toxic and volatile solvent, acetonitrile, by environmental friendly, high polarity and low volatile organic solvent propylene carbonate. Salt optimization was done by varying the weight of tetrapropylammonium iodide (TPAI) salt for new composition of electrolyte and DSSCs fabricated with above electrolytes were characterized with I-V measurements. Electrical Impedance Spectroscopic measurements were used to characterize the interfacial resistance of the different interface in the DSSC. The DSSC with the highest power conversion efficiency of 6.67% was achieved by using an electrolyte prepared with 0.17g of Tetrapropylammonium iodide (TPAI) salt dissolved in 0.4g of ethylene carbonate (EC) and 0.4g of propylene carbonate (PC), which gives almost the same efficiency as obtained with an electrolyte having acetonitrile as the solvent. This shows that acetonitrile can be replaced by propylene carbonate solvent without affecting the performance of DSSCs.

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