

## SIGNIFICANCE OF 4-*TERT*-BUTYLPYRIDINE IN IONIC LIQUID ELECTROLYTE BASED DYE- SENSITIZED SOLAR CELLS

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### ABSTRACT

Current studies on dye-sensitized solar cells (DSCs) are mainly focused on developing low-cost high performance cells utilizing simple techniques for their fabrication. DSC is composed of four main parts; namely the working electrode, sensitizer, redox electrolyte and the counter electrode. Liquid electrolytes used in ordinary DSCs are usually composed of a redox couple, additives and a polar organic solvent such as acetonitrile. The shielding of volatile organic solvent to prevent its evaporative losses is the main problem of those DSCs which hinders the long-term stability. The best alternative to replace volatile organic solvent is perhaps an ionic liquid (IL) which has good solvent properties with zero vapor pressure, high electrochemical and thermal stabilities. ILs consisting of imidazolium salts have been commonly used as solvents for DSCs. In this research, low-viscosity ionic liquid 1-methyl-3-propylimidazolium iodide (MPII) with 0.4 M I<sub>2</sub> was used as an electrolyte. Several additives could be added to the electrolyte in order to increase the photocurrent or photovoltage characteristics of DSCs. Addition of 4-*tert*-butylpyridine (TBP) to the IL based electrolyte results in the increased open circuit voltage (VOC). Under simulated sunlight (AM 1.5 at 100 mW cm<sup>-2</sup>), the DSC with the above electrolyte containing TBP additive showed higher conversion efficiency of 7.94% which is in contrast to 5.15% obtained for the DSC containing IL electrolyte without TBP thus accounting for the substantial increase in VOC of 25% when TBP is present in the electrolyte. TBP tends to decrease the recombination of injected electrons and shift the conduction band potential of the working electrode towards higher values and thereby leading to increased VOC and hence increased conversion efficiency.

Keywords: Dye-sensitized solar cells, Ionic liquid, 4-*tert*-butylpyridine, Solvent