

Fluorinated electrolytes for DSSCs

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Dye-sensitized solar cells (DSSCs), which are based on dye molecules, nanoporous titanium dioxide, and I^-/I_3^- redox couple electrolyte, have attractive features in terms of the high light-to-electricity conversion efficiency¹, and low production cost. In many studies, ionic liquids (ILs) have been used as effective electrolytes, because of their unique, advantageous properties such as low vapour pressure, non-flammability, high ionic conductivity, and gel forming properties with polymers.

In this communication we show the use of fluorinated ILs as solvent-free electrolytes in DSSCs. Fluorine atoms bind tightly to carbon in organic molecules and modest fluorination of the molecular structure leads to large changes in the physical and chemical properties of that molecule². Fluoro-organic compounds feature a variety of new functional properties, including: enhanced hydrophobicity (but high lipophobicity), high thermal and oxidative stability (resistance to sunlight), weak intermolecular interactions, and low surface energy and surface tension. Moreover, fluorinated substances generally show: a low refractive index (low light absorption), exceptional chemical inertness, and high fluidity.

Therefore we synthesised new fluoroalkyl-substituted imidazolium ionic liquids which can be suitable for working as thermotropic liquid crystal or low viscosity ionic liquid materials. We are currently exploring both of these properties for electrochemistry applications, testing the materials as solvent-free electrolyte in DSSCs.

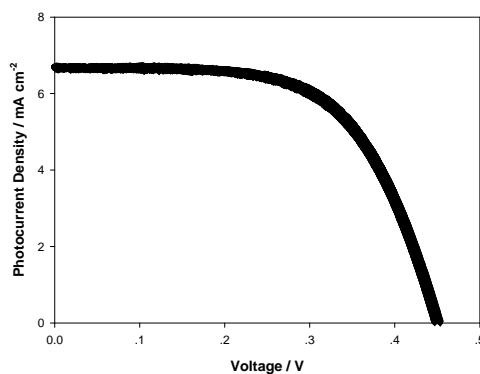


Figure 1. Photocurrent density-voltage characteristics of DSSC with fluorinated ionic liquid electrolyte at AM 1.5 (99.2 mW/cm²) illumination.

References

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2. A. Abate, P. Metrangolo, G. Resnati, and G. Terraneo, *J. Fluor. Chem.*, 2009, **130**, 1171-1177