University of Bath

Laurie Peter DSC Group

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The DSC group at Bath currently comprises 5 PhD students, 1 postdoc and 1 Commonwealth Research Fellow. Theoretical aspects are pursued in collaboration with Dr Alison Walker (Physics). Projects include the EPSRC Supergen Excitonic Solar Cell Consortium (led by Bath; members Bath, Cambridge, Edinburgh, Imperial College, Warwick), a joint EPSRC project on dye-cells on metal substrates (Bangor, Bath, Corus Coatings, Imperial College, Swansea) and an EPSRC project on new dyes. In addition joint work on titania nanotubes is being carried out with Patrik Schmuki (Erlangen).

The group is mainly interested in characterising *electron transport* and *interfacial electron transfer* in dye-sensitized cells. The types of dye-sensitized cells studied include liquid electrolyte cells, organic hole conductor cells, titania nanotube cells and cells sensitized by inorganic semiconductor particles. The following table lists the experimental techniques used in Bath and indicates the type of information that is obtained.

Technique	Information
AM 1.5 IV characteristics	I_{sc}, V_{oc}, FF
Photocurrent spectroscopy	IPCE, predicted I_{sc} (AM1.5)
Dye desorption	Dye loading, injection efficiency
Photocurrent and photovoltage transients	Electron transport and back reaction rates
Intensity modulated photocurrent spectroscopy (IMPS)	Electron transport properties
Intensity modulated photovoltage spectroscopy (IMVS)	Electron lifetime
Light modulated infrared spectroscopy (LMIRS)	Electron trapping, transport, back reaction
Photovoltage decay	Electron trapping and back reaction
Charge extraction	Trap distribution and density
Impedance spectroscopy	Electron transport, trapping, back reaction
Photoinduced absorption spectroscopy	Rates of dye regeneration
Spectroelectrochemistry	Dye redox properties and regeneration rates
Mott Schottky plots (Hg or liquid contacts)	Blocking layer doping density
Ti 'top electrode' measurements	Internal quasi-Fermi level

Recent papers

1. Characterization of solid-state dye-sensitized solar cells utilizing high absorption coefficient metal-free organic dyes. *J. Am. Chem. Soc*. **130**, 1367-1375 (2008).
2. A reappraisal of the diffusion length of electrons in solid state dye-sensitized solar cells. J. R. Jennings and L.M. Peter, *J. Phys. Chem. C.* **111**, 16100-16104 (2007).
3. Characterization and Modelling of Dye-Sensitized Solar Cells. L.M. Peter. *J. Phys. Chem. C.* **111,** 6601-6612 (2007).
4. Dye-sensitized nanocrystalline solar cells. L.M. Peter, *Phys. Chem. Chem. Phys.*, **9**, 2630-2642 (2007).
5. Solid state dye-sensitized solar cells based on spiro-MeOTAD. W. H. Howie, J. E. Harris, J. R. Jennings and L. M. Peter, *Sol. Energy Mater.*, **91**, 424-426 (2007).