UPSCALING ULTRA-FAST CO-SENSITIZATION OF DYE-SENSITIZED SOLAR CELLS

Peter J. Holliman[a], Leo Furnell[a], Rosie Anthony[a], Arthur Connell[a], Christopher P. Kershaw[a], Eurig W. Jones[a], Jenny Baker[a] , Renan Escalante[b], Dena Pourjafari[b], and Gerko Oskam[b]

[a] College of Engineering, Swansea University, Bay Campus, Swansea SA1 8EN, UK
[b] Department of Applied Physics, CINVESTAV-IPN, Mérida, Yucatán 97310, México.

(This Abstract is for an oral presentation to be delivered by Prof Peter Holliman – **p.j.holliman@swansea.ac.uk**)

Dye-sensitized solar cell devices have recently shown significant improvements in device efficiency with several examples of liquid DSC devices reaching η > 12% with one report of η = 14.7% [1]. The improvements in liquid devices have often arisen from the use of co-sensitization of two dyes.

In this talk, we will present the first studies of the ultra-fast sensitization of large-scale (*ca.* 20 cm^2) mesoporous TiO_2 photo-anodes as well as small modules for use in dye-sensitized solar cell devices. We have studied these processes *in situ* using digital imaging to monitor colour change and then extracted that colour data as RGB data for subsequent analysis. Rates of dyeing and spatial distribution of dye have been investigated as well as co-sensitization using different coloured dyes (e.g. half-squaraine dyes [2,3]) including varying the order of dye addition. We have correlated these data with UV-visible spectroscopy and device performance.

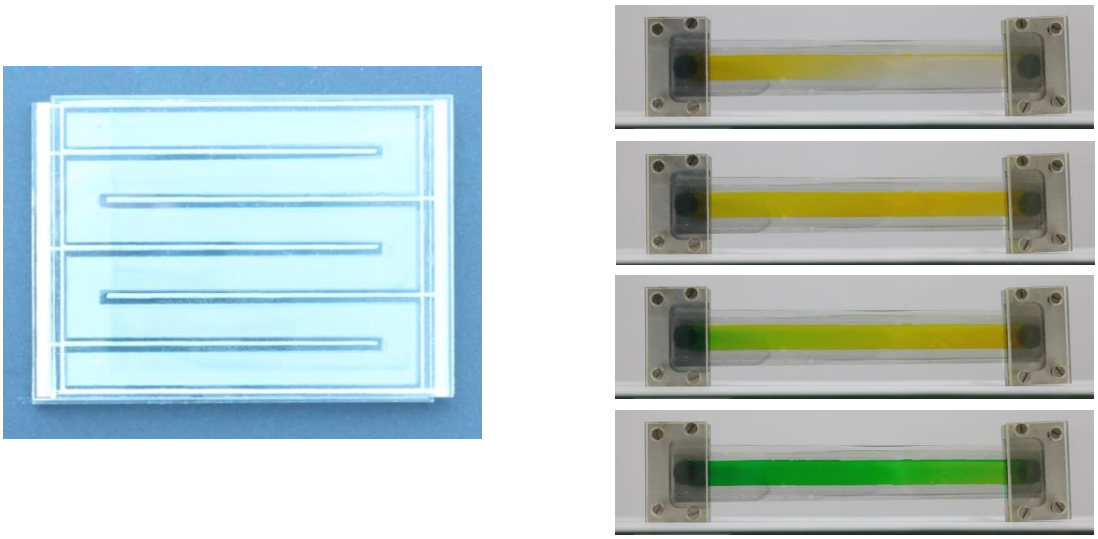

Fig. 1 (Left) TiO_2 module and (right) ultra-fast co-sensitization of 15 cm long DSC TiO_2 devices

References

1. K. Kakiage, Y. Aoyama, T. Yano, K. Oya, J. Fujisawa, M. Hanaya, *Chem. Commun*., 2015, **51**, 15894.
2. A. Connell, P.J. Holliman, M.L. Davies, C.D. Gwenin, S. Weiss, M.B. Pitak, P.N. Horton, S.J. Coles, G. Cooke, *J. Mater. Chem. A*, 2014, **2**(11), 4055.
3. A. Connell, P.J. Holliman, E.W. Jones, L. Furnell, C. Kershaw, M.L. Davies, C.D. Gwenin, M.B. Pitak, S.J. Coles, G. Cooke, *J. Mater. Chem. A*, 2015, **3**, 2883.