UNIVERSITAT JAUME•I

Lab session 2: Dye solar cells

Objective:
Fabricate and characterize a Dye solar cell.

Materials

Nanoporous TiO_2 Films
3-methoxypropionitrile, (3-MPN)
Iodine (I_2)
Lithium Iodide (LiI)
1-methylbenzimidazole (MBI)
cis-$(NCS)_2$(2,2o-bipyridyl-4,4odicarboxylate)$_2$Ru(II) (N3 ruthenium dye)
acetonitrile and tert-butyl alcohol (1:1 solution)
Platinized FTO Glass
clamps
Lamp
2 Polimeters
Variable resistor
Power meter

Procedure:
- DSC fabrication
Immerse the TiO_2 electrode into a 0.5mM N3 dye solution in a mixture of acetonitrile and tert-butyl alcohol (volume ratio: 1:1) and kept at room temperature for 20–24 h to complete the sensitiser uptake
Assemble the dye-covered TiO_2 electrode and the Platinised glass in a sandwich cell and fix it with clamps.

- DSC characterization
With the powermeter, measure the light intensity of the lamp.
Shine light over the samples and with the polimeters measure the Current and Voltage of the cell (i-V curve) by fixing the potential through the variable resistor from short circuit current (i_{sc}) to open circuit potential (V_{OC}). Take 10 values of i-V. Measure the surface (S) of the TiO_2 film and normalize the current to obtain current density (J=i/S).

Results
Make the plots of J-V curve and Power-V and provide the values of J_{sc}, V_{oc}, *FF* and Efficiency.

References: [1-3]

1. Bisquert, J. Células solares de titanio nanoestructurado sensitivizado. Alternativas para la generación fotovoltaica. *Era solar* **2002,** *110*, 56-63.
2. Ito, S.; Chen, P.; Comte, P.; Nazeeruddin, M. K.; Liska, P.; Péchy, P.; Grätzel, M. Fabrication of screen-printing pastes from TiO2 powders for dye-sensitised solar cells. *Progress in Photovoltaics: Research and Applications* **2007,** *15* (7), 603-612.
3. Fabregat-Santiago, F.; Bisquert, J.; Garcia-Belmonte, G.; Boschloo, G.; Hagfeldt, A. Influence of electrolyte in transport and recombination in dye-sensitized solar cells studied by impedance spectroscopy. *Solar Energy Materials and Solar Cells* **2005,** *87* (1-4), 117-131.