Fabrication and characterization of photochromic Dye-Sensitized Solar Cells

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Dye-sensitized solar cells (DSSCs) are devices easy to manufacture that have attractive characteristics for building integrated photovoltaics (BIPV). In recent years, many organic dyes have been developed for this application and some of them have demonstrated promising performances, allowing the fabrication of solar cells and modules combining high efficiency, transparency and stability. [1-2]

Photochromic dyes are molecules that possess unique optical properties that can be controlled by light absorption. So far, they have been exploited in various fields, including optics, biomedicine and optoelectronics but rarely in photovoltaics. Recently, we have developed photochromic dyes for using them as photosensitizers in DSSCs. We have demonstrated that these photochromic dyes can act as effective photosensitizers in DSSCs. [3-4-5-6]

In this practical course, we will show the different steps in the fabrication of semi-transparent DSSCs. We will show how to prepare the different electrodes and the procedure to graft the dye on the surface of the photoanode. We will show how to assemble the different elements (photoanode, counter electrode and electrolyte). We will show how to characterise electrically these solar cells under illumination with a solar simulator in order to evaluate the performance of the cells and calculate their maximum power conversion efficiency. We will also show how to measure the transparency and colour variations of the cells by UV-Visible spectroscopy.

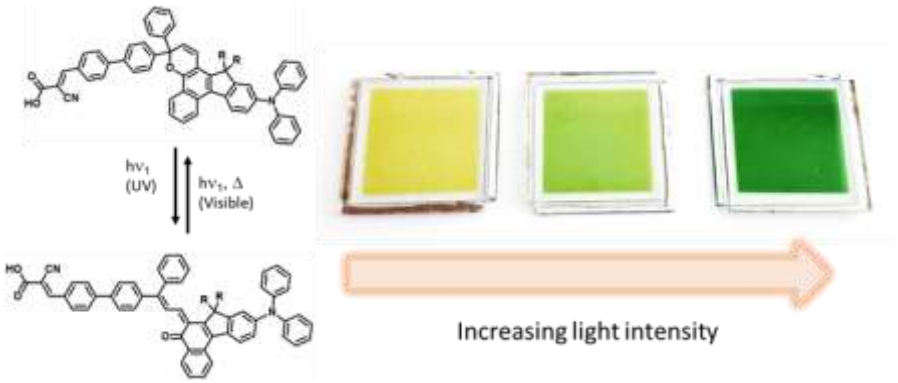

Figure: Example of a photochromic dye, and solar cells using it, under various irradiation conditions

References: [1] D. Joly et al., Energy Environ. Sci., **2015**, 8, 2010-2018; [2] M. Godfroy et al., Sustain. Energy Fuels, **2021**, 5, 144-153 ; [3] Q. Huaulmé et al. *Nature Energy.* **2020**, *5*, 468-477.; [4] J. Liotier et al., *Solar RRL.* **2021**, 2100929. ; [5] A. J. Riqueleme et al., *ACS Applied Energy Materials,* **2021**, *4*, 8941-8952. ; [6] J.M. Andres-Castán., *Mater. Chem. Front*., **2022**, *Advance Article.*

Virtual visit of the facilities: http://www.cea.fr/multimedia/Pages/richmedias/visites-virtuelles/hybriden.aspx

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