

Coupling of a Copper Dye with a Copper Electrolyte: the Birth of Sustainable “Full-Copper” Dye-Sensitized Solar Cells

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To have enough clean and low cost energy for the future is one of the world's most important challenges. Since the discovery of Grätzel-type dye-sensitized solar cells (DSSCs) as a convenient way for harnessing the energy of the sun and converting it into electricity, there has been a lot of effort to improve the photo-conversion efficiency, trying to optimize the sensitizer and the redox mediators. Until recently, the most efficient DSSCs were based on ruthenium complexes as dye and the iodide/triiodide couple as redox mediator. However, ruthenium is one of the rarest and most expensive metal, and this is a drawback in the design of low-cost DSSCs. Photophysical, economic, and environmental considerations make copper(I) coordination compounds interesting alternatives to ruthenium dyes [1-2]. Besides, it was found that Cu-based mediators can outperform both iodine-based and Co-based electrolytes [2]. These observations were the springboard for the first “full-copper” DSSCs in which a copper(I) dye is coupled with a copper(I)/(II) electron shuttle, of great interest for the development of novel low cost and environmentally friendly DSSCs.

This presentation is on the birth of “full-copper” DSSCs. First, it will be shown how homoleptic and heteroleptic copper(I) dyes can be coupled with the common Γ/I_3^- redox couple to prepare DSSCs with a good efficiency. Then, some examples of the use of homoleptic Cu(I)/(II) mediators, in combination with both ruthenium(II) dyes and organic dyes, will be given. Finally, the coupling of a copper dye with a copper electrolyte as a fascinating route for sustainable “full-copper” DSSCs will be presented.

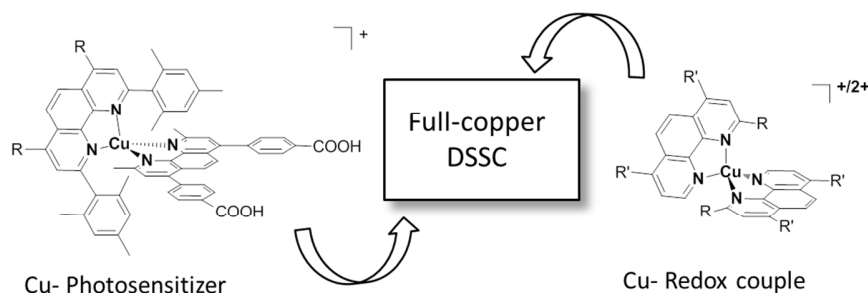


Figure 1: general structure of the involved copper complexes

[1] C. E. Housecroft, E. C. Constable, *Chem. Soc. Rev.* **2015**, 44, 8386- 8398.

[2] M. Magni, P. Biagini, A. Colombo, C. Dragonetti, D. Roberto, A. Valore *Coord. Chem. Rev.* **2016**, 322, 69-93.