Organic sensitizers and metal oxides electrodes for efficient and stable Dye Sensitized Solar Cells.

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Dye-sensitized solar cells (DSSCs) are photo-electrochemical devices capable to convert solar radiation directly into electricity. Tremendous progress has been achieved in the past decade regarding the efficiency of DSSCs with record over 13%,[1] and this technology appears nowadays as a realistic approach for building-integrated photovoltaics (BIPV). The development of new sensitizers and electrode materials has boosted their commercial attractiveness thanks to improved performances, higher stability, and cost reduction. In order to enhance the performances of DSSCs, the first strategy that was envisioned by researchers consists in developing cheap, colorful, stable and highly efficient organic dyes to replace ruthenium-based complexes classically employed for the sensitization of the electrodes. In the first part of this lecture, after introducing the working principles of DSSCs, we will discuss the synthesis of purely organic dyes, alternatives to ruthenium complexes, specifically designed for the sensitization of nanostructured metal oxide electrodes. We will show that good performances can be achieved using this strategy with power conversion efficiency over 10% and high stability over more than 9000 h upon irradiation. [2-3]

The second strategy consists in developing new techniques to create mesoporous thin films based on metal oxides nanomaterials. These mesoporous photoanodes should have potentially higher electron mobility to replace TiO_2 which is routinely used. In the second part of this lecture we will present several approaches for the preparation of Zinc-based ternary metal oxides nanoparticles (nanowires, nanofibers) to replace TiO_2 in photoanodes and their use for the fabrication of DSSC. We will show that electrospray and electrospinning are highly promising and versatile techniques for the fabrication of photoanodes where the chemical structure and the crystallinity of the final nanostructures can be very easily tuned. [4-5]

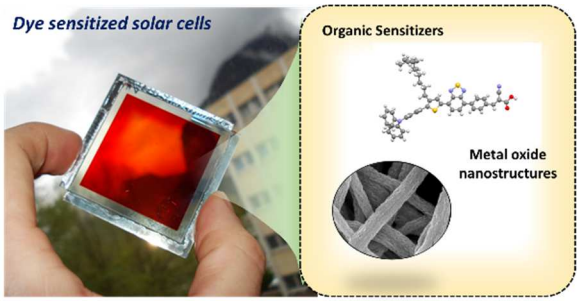

Figure 1: *picture of a semi-transparent DSSC and materials used for its fabrication*.

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