

# Séminaire



**Mardi 17 janvier 2023 à 10h30**  
**Amphithéâtre Henri Benoît et visio**

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# Design and synthesis of organic functional materials and their optoelectronic properties

Dye-sensitized solar cells (DSCs) are molecular photovoltaics that convert light into electricity using photosensitizers adsorbed on the surface of nanocrystalline mesoporous TiO<sub>2</sub> films used in conjunction with either electrolyte solutions containing redox mediators or solid charge-transport materials. Because the opto-electronic properties of the photosensitizers can be readily tuned by judicious tailoring of the molecular design, DSCs can appear in a variety of colors offering aesthetically pleasing appearance, which is advantageous for glass facade applications. However, colour has been rarely studied in the last 20 years, and especially the lack of highly efficient and stable blue dyes. In addition, the power conversion efficiency (PCE) of DSCs has not been improved too much in the last few years. In this seminar, I will talk about a series of studies addressing these two key scientific points. The breakthrough of blue dye was achieved by using anthracene as the main unit through the chemical innovation, such as  $\pi$ -extension, modification of steric space, introduction of heteroatom, and construction of more rigid coplanar electronic skeleton<sup>1</sup>. Furthermore, we put forward a novel approach to realize a green semi-transparent solar cell using a blue dye<sup>2</sup>. Then, I will talk about how to improve the efficiency of DSCs targeting the world record values. We first put forward a new co-sensitization strategy<sup>3</sup>, and further report a route of pre-adsorbing a monolayer of a hydroxamic acid derivative on the surface of TiO<sub>2</sub> to improve the dye molecular packing and photovoltaic performance of co-adsorbed sensitizers<sup>4</sup>, setting a new benchmark efficiency for DSCs.

[1] Y. Ren et al. *J. Am. Chem. Soc.* **2018**, *140*, 2405–2408. [2] Y. Ren et al. *Adv. Mater.* **2020**, *32*, e2000193. [3] Zhang D.<sup>#</sup>, Stojanovic M.<sup>#</sup>, Ren Y.<sup>#\*</sup> et al., *Nat. Commun.* **2021**, *12*, 1777. [4] Ren Y.<sup>#</sup>, Zhang D.<sup>#</sup> et al., *Nature*, **2022**, doi :10.1038/s41586-022-05460-z.

**Les personnes souhaitant rencontrer Yameng Ren sont priées de prendre contact avec Andreas Vargas-Jentzsch.**