Exploring the potential of photochromic spiro-indoline naphthoxazines and naphthopyrans as photosensitizers in dye-sensitized solar cells

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Photochromic dyes possess peculiar properties that can be exploited in different domains, including optics, biomedicine and optoelectronics. Recently, we have undertaken the task to explore the potential of several families of photochromic dyes including spiro-indoline naphthoxazines, spiro-indoline naphthopyrans, and diphenyl-naphthopyrans for photovoltaic applications. We designed and synthesized new push-pull photosensitizers with a donor-pi-acceptor structure embedding these units as photochromic cores.[1-2] Their optical, photochromic and acidochromic properties were thoroughly studied to establish structure-properties relationships.[3] In this communication, we will disclose the synthetic strategies to prepare these new photochromic photosensitizers and we will discuss their unique optoelectronic properties. Then we will demonstrate that these dyes can act as photosensitizers in DSSCs. Finally, we will demonstrate that under solar irradiation, photochromic DSSCs comprising some of these molecules can vary their colour, self-adapt their visible light transmission and simultaneously convert light into electricity with a power conversion efficiency of up to 4.2%.[1] We will show that photochromic semi-transparent mini-modules can be fabricated with these dyes. Our work opens new perspectives of application for photochromic dyes, and it provides novel research directions to design photochromic photosensitizers with improved optical and photovoltaic properties.

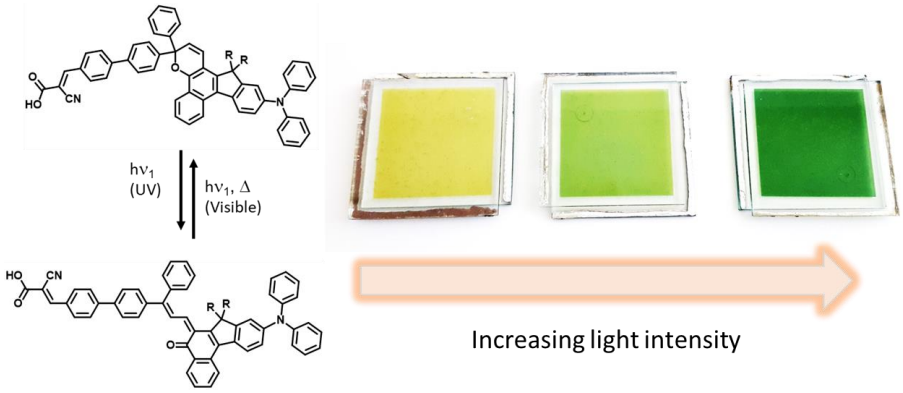

Fig: Photo-isomerization of a push-pull photochromic dye and pictures of solar cells comprising it.

1. Q. Huaulmé, *Nature Energy.* **2020**, *5*, 468-477.

2. J. Liotier, *Solar RRL.* **2021**, 2100929.

3. A. J. Riqueleme, *ACS Applied Energy Materials,* **2021**, *4*, 8941-8952.

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