INSIGHTS ON COMPONENTS OPTIMIZATION TO REACH COLOR-NEUTRAL AND HIGHLY TRANSPARENT NEAR-INFRARED DYE-SENSITIZED SOLAR CELL

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In the research for innovative glazing, Dye Sensitized Solar Cells (DSSC) represent an interesting and effective way to achieve energy conversion and visual comfort by being wavelength selective for the NIR. In this context, our work aims to pave the way to selective NIR-sensitizers integrated into a new type of DSSCs being completely transparent and colorless in the whole visible region while harvesting light in the NIR where sunlight possesses ca. 40% of the photon flux and Human cones are not sensitive. Taking into account that the calculated wavelength cut-off to reach color neutrality corresponds to absorbance under 435nm and over 670nm, cyanine dyes represent the best candidates due to their capability to have a sharp and strong absorption in the NIR region without any significant residual in the visible.[1] This was demonstrated in our work on VG20 series dyes, where we reached a NIR-DSSC attaining up to 3.1% efficiency and an average visible transmittance (AVT) greater than 75%.[2] However, we further improve our system by a careful optimization on sensitization conditions, photo-anode transparency, and electrolyte development, obtaining a neutral-color and highly transparent DSSC exhibiting an AVT greater than 80% and a high color rendering index (CRI) of 96% and attaining 2.5% efficiency. In this communication, we will discuss the strategies we implemented to reach these results by combining a colorless and transparent sulfur/iodide-based electrolyte[3] with VG20-C_{16} dye and studying the effect of the photoanode thickness on this system in terms of aesthetics and performance.

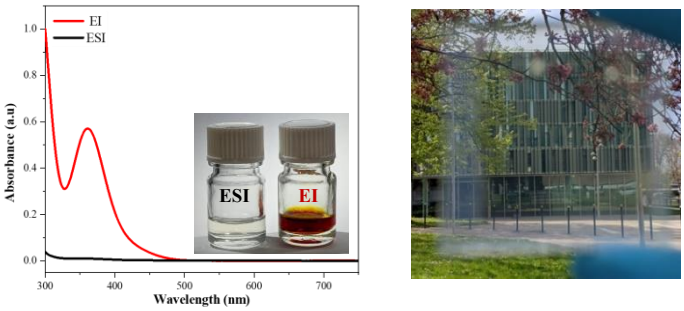

Figure 1. UV-Vis of sulfur/iodide-based electrolyte (ESI) compared to the benchmark I_3^-/I^- (EI) (left) and picture of colorless and transparent NIR-DSSC with VG20-C_{16} dye and ESI electrolyte (right).

References:

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