Zinc phthalocyanine absorbance in the near-infrared with application for transparent and colorless dye-sensitized solar cells

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Abstract

Transparent and colorless solar cells are attractive new photovoltaic devices as they could bring new opportunities to harness sunlight energy and particularly for their integration in windows. In this work, a new zinc phthalocyanine was synthesized and investigated as sensitizer in dye-sensitized solar cell (DSSC) for this purpose. The zinc phthalocyanine features a benzoic acid anchoring group and six thio(4-tertbutylphenyl) substituents in α position of the phtalocyanine. The dye was characterized by absorption and emission spectroscopy and by electrochemistry. The physicochemical properties show that the dye fulfills the criteria for such an application. A detailed computational study indicates that the electronic communication with TiO_2 conduction is weak owing to the absence of overlapping of the wavefunctions of the dye with those of the TiO_2 semiconductor. The photovoltaic performances of the zinc phthalocyanine were measured in TiO_2-based DSSC that revealed inefficient electron injection, which certainly can be explained by the weak electronic coupling of the dye with TiO_2 that limits electron injection efficiency. A strategy is proposed to make better-performing sensitizers.

Author keywords

Dye sensitized solar cell; Near infrared; Phthalocyanine; Solar cell; Solar energy