Pyrrolopyrrole cyanine dyes as Near InfraRed photosensitizer for hydrogen production via water reduction using Dye Sensitized Photocatalysis system

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The conversion of sunlight into chemical energy is a promising solution to accompany the energy transition and limit global warming. Hydrogen is a particularly attractive energy vector because it could meet 18% of the world's energy demand by 2050.[1] Among the various approaches to convert solar energy into hydrogen, DSPs (Dye Sensitized Photocatalytic) are particularly suitable because they are easy to manufacture and they are based on low cost materials.[2] Such devices rely on electron transfer between a photosensitizer co-grafted with a proton reduction catalyst on nanoparticles of a semiconductor such as TiO_2 (Figure 1). However, most of the sensitizers integrated in these systems absorb only in the visible range and very little in the NIR. There is only a handful examples of reports with phthalocyanines[3] and squaraines towards this objective but with limited efficiencies.[4] In study, we have extended the field of application of pyrrolopyrrole cyanine dyes (PPcys) to DSPs systems for hydrogen production. Indeed, PPcys have proved to be currently the most efficient NIR dyes for transparent and colorless DSSC (Dye Sensitized Solar Cell).[5] This presentation focuses on hydrogen production with DSP sensitized with PPcy. We demonstrate the potential of this class of dyes to evolve hydrogen with low energy photon (> 750 nm) with unmet performances.

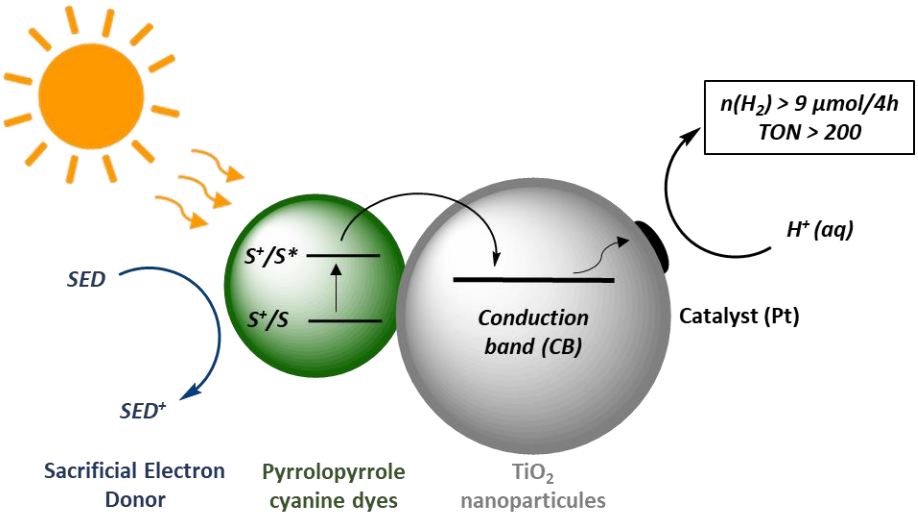

Figure 1. Illustration of the working principle of a DSP system.

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