STUDY OF cis-[Ru(DcBpy)$_2$(PTA)$_2$]Cl$_2$ AND ITS USE IN DYE-SENSITIZED SOLAR CELLS

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Introduction

Increasing interest on solar cell has been boosted due to the mandatory needed of obtaining clean, economical, and safe electrical energy. The most widely used solar cells are those based on silicon, which achieve a reasonable conversion efficiency (>15%).[1] However, their high price has pushed the researcher for seeking more economical alternatives. Michael Grätzel described in 1991[2] a new type of low-cost solar cells with practical energy conversion efficiencies

Dye-Sensitized Solar Cells

These solar cells, called DSSCs (Dye-Sensitized Solar Cells) consist of an optically transparent layer of TiO_2 particles covered with a monolayer of a photosensitive dye that captures incident light. Many different types of dyes, both organic and inorganic, have been used to manufacture CSCs. Among all of them, those based on ruthenium complexes have become very important due to their photoelectrochemical properties and their high stability in the oxidation state. Specifically, the polypyridyl-Ru-type complexes have showed conversion yields above 11% under solar standard lighting.[3]

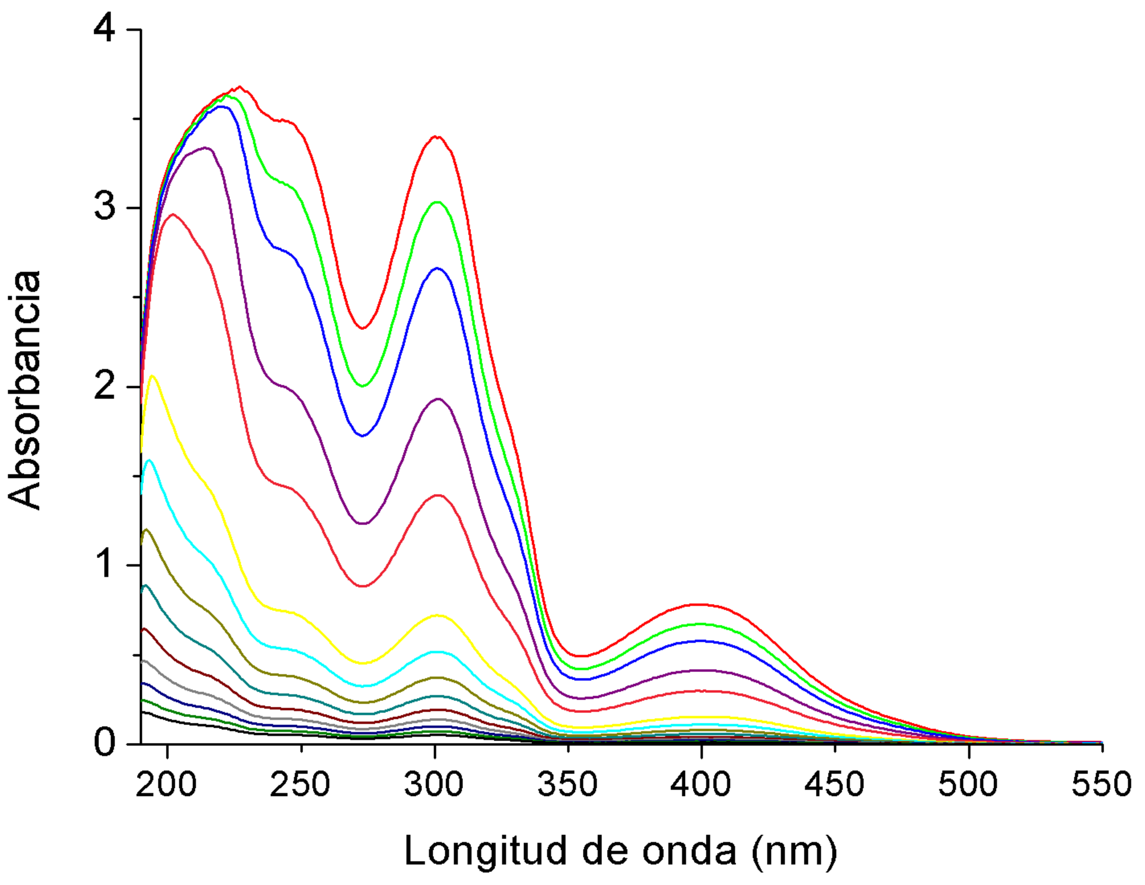

Figure 1. UV-Vis absorption bands of [Ru(DcBpyH)$_2$(PTAH)$_2$]Cl$_2$ in water from 1,47·10^{-4} M to 2,66·10^{-6} M at 20°C

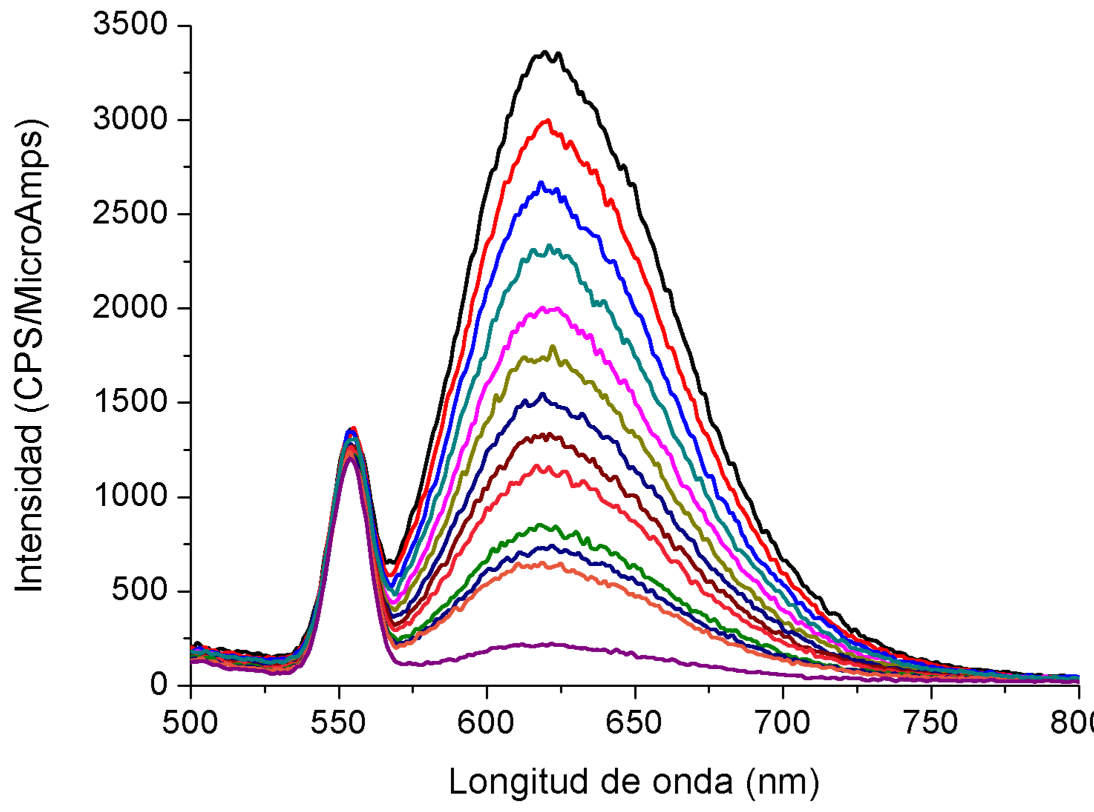

Figure 2. Fluorescency emission spectrum (λex = 400 nm) of cis-[Ru(DcBpyH)$_2$(PTAH)$_2$]Cl$_2$ in water from 3,54·10^{-4} M to 1,62·10^{-5} M at 20° C. $\Phi_F = 7,84 \cdot 10^{-4}$

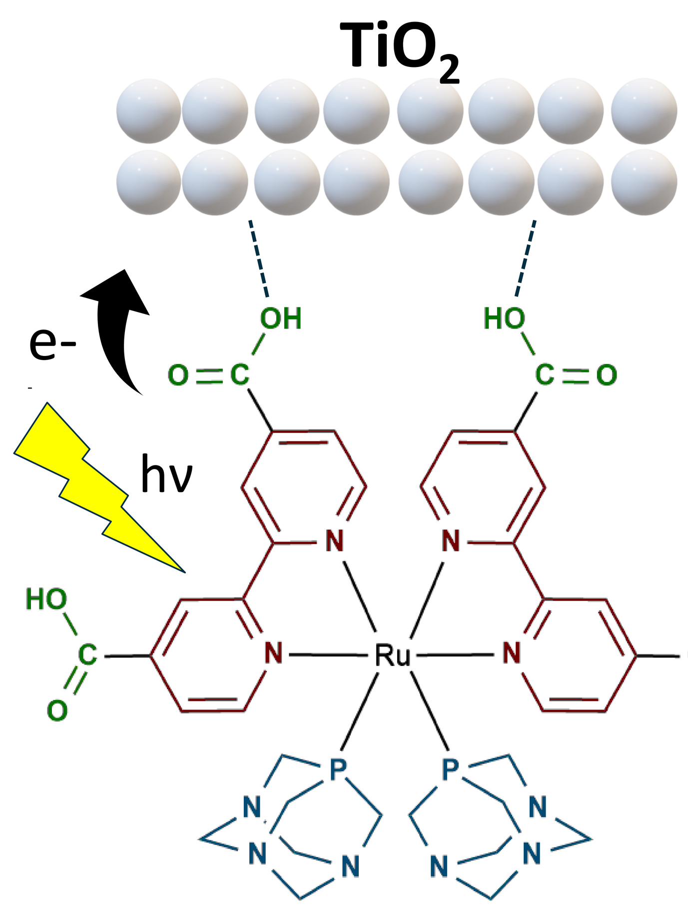

Figure 3. Molecule of dye with the probable attachement on the TiO_2 layer.

Intensity-Voltage measurements curves

Recently, our research group has synthesized and characterized the cis-[Ru(DcBpy)$_2$(PTAH)$_2$]Cl$_2$ complex in order to study its possible use as a Grätzel solar cell dye. The dye was adsorbed onto the TiO_2 layer by immersing the cells in a 50 mg solution of cis-[Ru(DcBpy)$_2$(PTAH)$_2$]Cl$_2$ in 5 mL of water (1-10^{-2} M). It was observed that the same solution can be used as electrolyte. The Intensity-Voltage curves for these cells were obtained by carrying out the measurements at 20°C. Although the efficiency of the obtained cells is quite limited and far from the published results, the device is working out featuring two significant advantages over the known dye solar cell: the solvent is water, therefore is available the use of a large variety of material such as plastic for building the cells, and the electrolyte is the same dye, making simpler the cell and reducing corrosion problems.

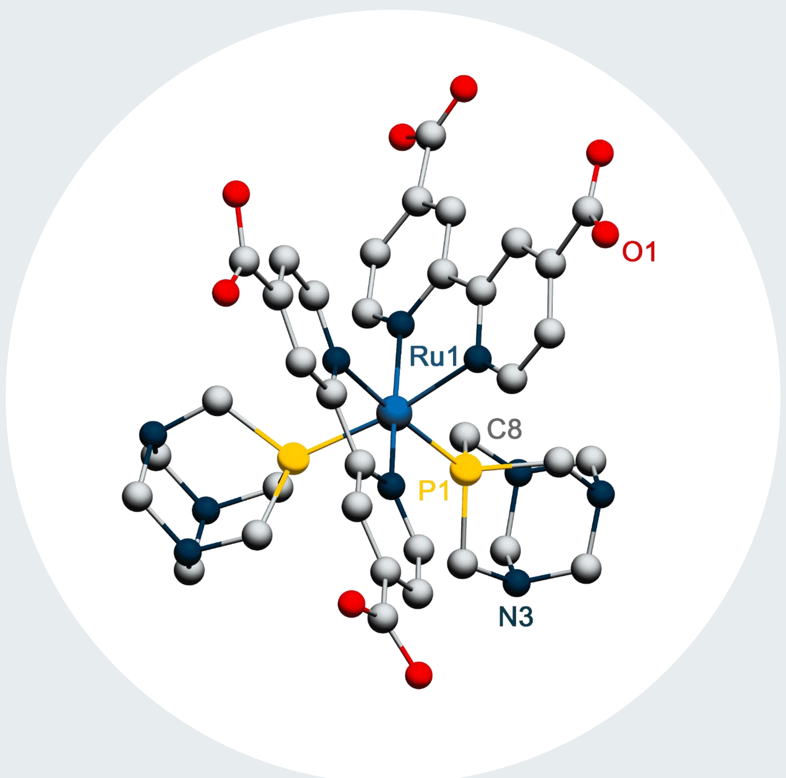

Figure 4. Crystal structure of *cis*-[Ru(DcBpyH)$_2$(PTAH)$_2$]Cl$_2$.

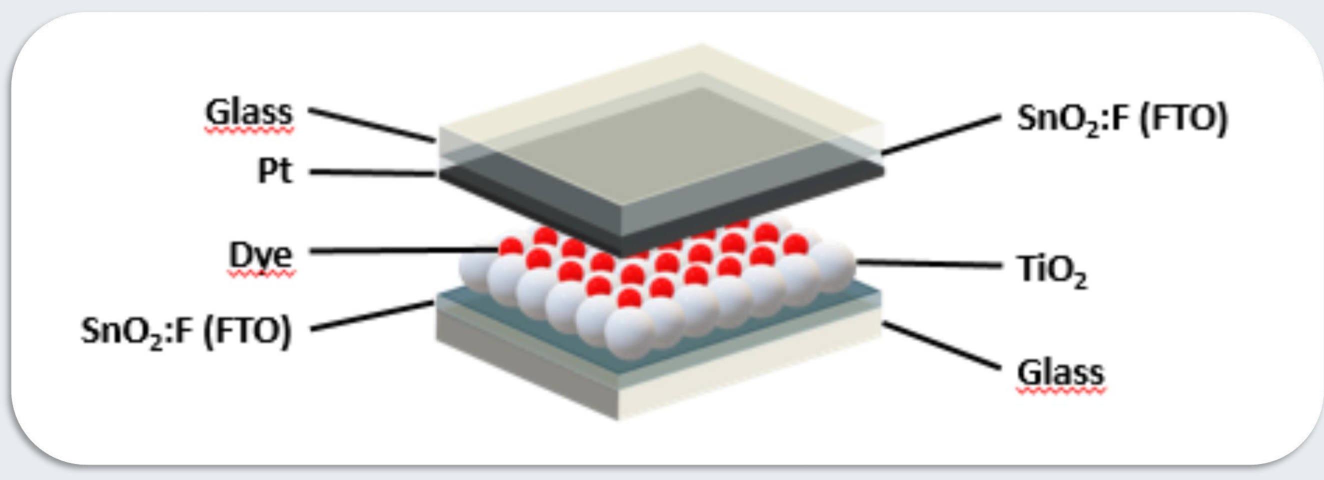

Figure 5. Scheme of a Dye-Sinsetized Solar Cell

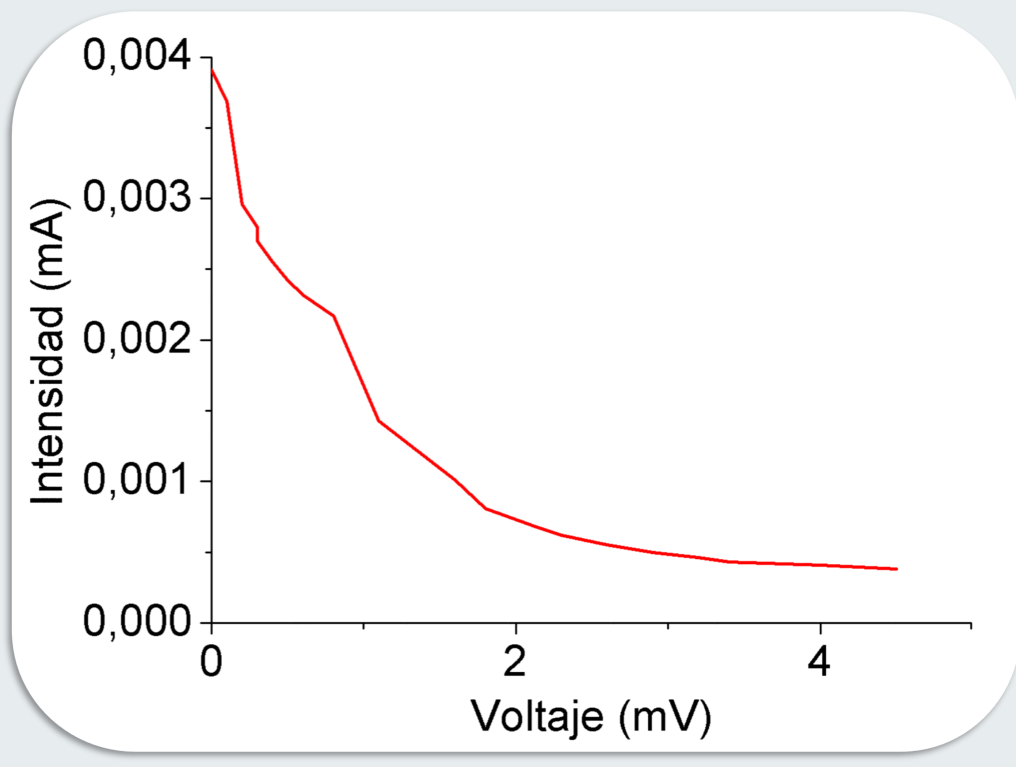

Figure 6. Intensity vs voltage of the Grätzel cell using 1·10^{-2} M cis-[Ru(DcBpyH)$_2$(PTAH)$_2$]Cl$_2$ in water at 20°C, μ = 20%.

Acknowledgements

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