New Sensitizers for Nanocrystalline TiO_2 Solar Cell Using Complexes with Bis-Phosphonated Bipyridine Ligands

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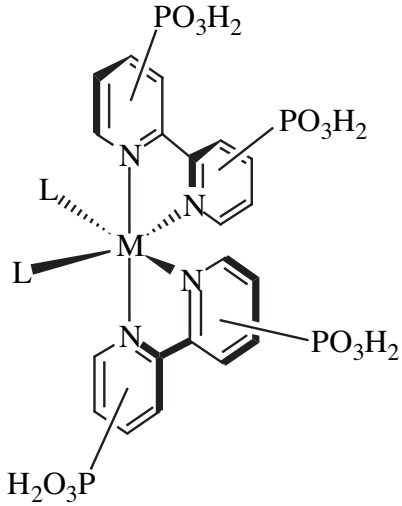
Solar energy represents more than ever an attractive source of energy since the realization of environmental damages caused by nuclear wastes and by carbon dioxide released by the burning of fossil energies.

Dye sensitization of nanocrystalline TiO_2 electrodes with ruthenium polypyridine complexes has proved to be a viable approach for the fabrication of photovoltaic cells.
In this type of solar cells, the dye is generally anchored to the nanoporous TiO_2 electrode via carboxylic functionality. The highly oxophilic group phosphonic acid has been reported to provide a stronger chemical attachment, due to its affinity to hard acid metal such as titanium(IV) in TiO_2.

The nature of the chemical linkage have profound consequences on both the stability of the TiO_2-Dye linkage that can affect the life span of the cell, but it also affect the magnitude of the electronic coupling of the dye with the semi-conductor. This latter factor is particularly important because it controls the kinetics of the interfacial electron transfer process and thus the overall cell efficiency.

In this communication, we report on the synthesis and on the comprehensive characterization of several transition metal complexes with bipyridines that are substituted with phosphonic acid groups (electrochemistry, photophyscial properties, action spectra and DFT molecular calculations).



L= Cl-, CN-, SCN- or acac
M=Ru(II) or Os(II)
PO_3H_2 in 4,4' or 5,5' positions

Figure : Structures of the sensitizers investigated in this work.

Reference :
I. Gillaizeau-Gauthier, F. Odobel, M. Alebbi, R. Argazzi, E. Costa, C. A. Bignozzi , P. Qu, G. J. Meyer. ***Inorg. Chem.*** 2001, 40, 6073.