PROGRAMUL DE COOPERARE ELVEȚIANO-ROMÂN
SWISS-ROMANIAN COOPERATION PROGRAMME

Development of Novel Materials for High Efficiency Dye-Sensitized Solar Cells

RSRP_IZERZ0_142144/1

Starting Date 01.09.2012

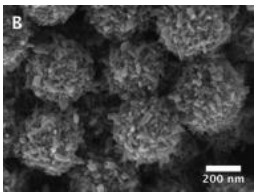
Duration 24 Months

Discipline Physics and Chemistry of Materials

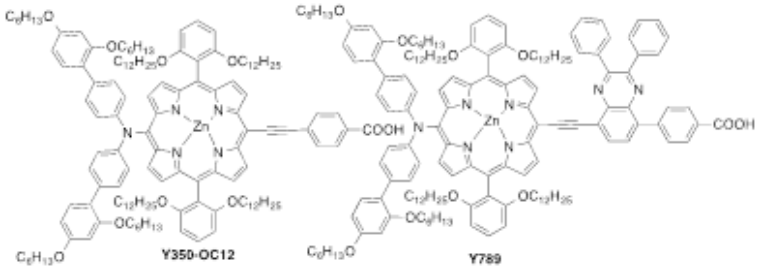
Main Goals

The goal of this project is twofold: *i*) to synthesize and characterize new materials to enhance the performance of dye-sensitized solar cells and *ii*) to perform computer simulations to better understand the interface processes that take place between the dye and the titania nanoparticle as well as between the dye and the electrolyte.

Activities and Results



- Synthesis of nanostructure materials to use as photo anodes. Tailoring the inorganic materials morphology, specific surface area, porosity, and surface activity of the semiconductor is a key factor to facilitate the diffusion of alternate redox electrolytes freely inside the pores of TiO_2 film. Figure shows scanning electron micrographs of TiO_2 beads which lead to power conversion efficiencies higher than 11%.



- Synthesis of a new porphyrin dye in which the auxiliary electron-withdrawing unit is a quinoxaline group. This modification brings several advantages, directionality in electron transfer from the donor to the acceptor and in tuning the molecular energy gap. The efficiency obtained with Y789 dye was higher than 12%.
- Synthesis and characterization of new cobalt complexes with mixed ligands based on bipyridyl and/or phenanthroline with various substituents, as possible redox electrolytes, to increase the open-circuit voltage. The open-circuit voltage was thus increased to over 1 V.
- Investigated the processes for making efficient blocking layers to improve the power conversion efficiency (PCE) of perovskite sensitized solid-state solar cells. The optimized device PCE reached above 17% at standard AM 1.5G solar illumination.
- Density Functional Theory calculations to study the anchoring of the dye and the charge transfer to the TiO_2 substrate, as well as the charge regeneration of the Y123 dye by $Co(phen)_2(byp)$.

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