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Materials for Solar Energy Conversion Systems: Dye-sensitized Solar Cells & Direct Water Splitting

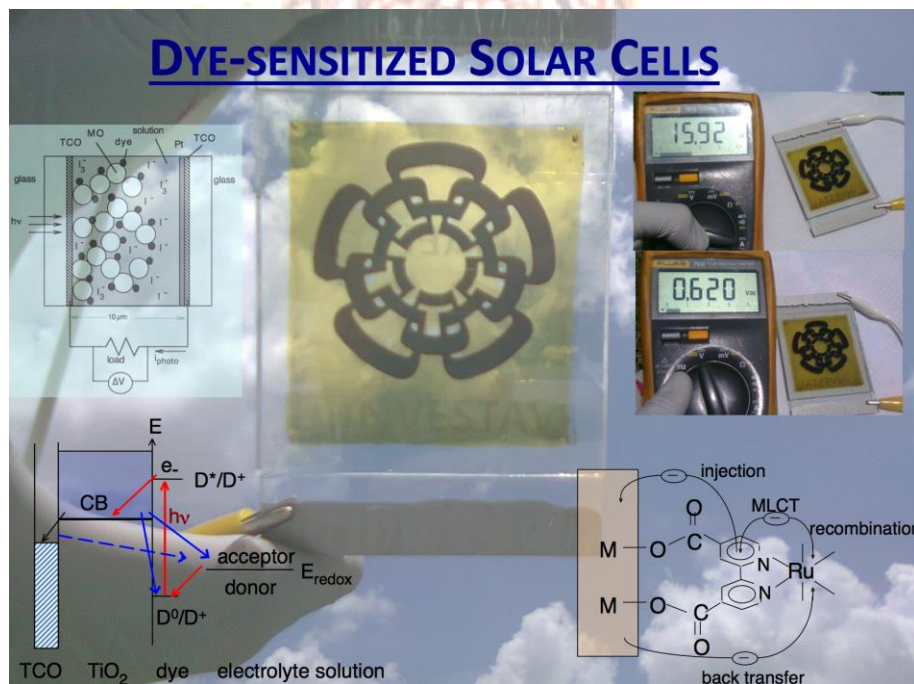
Gerko Oskam

Departamento de Física Aplicada, Cinvestav-IPN, Mérida, Yuc. 97310, México.

oskam@mda.cinvestav.mx

The dye-sensitized solar cell (DSC) is a third generation photovoltaic device based on nanomaterials that holds promise for the low-cost conversion of solar energy to electricity. The light absorbing electrode consists of a mesoporous, nanostructured metal oxide film, sensitized to visible light by an adsorbed molecular dye, which absorbs sunlight. The current record efficiencies are above 12%. On the other hand, the conversion of solar energy directly into clean fuels such as hydrogen is an important goal to be achieved in the near future. Currently, there is strong interest in the use of materials with specific optical and electronic properties for the direct splitting of water into oxygen and hydrogen.

In this presentation, examples will be given of research and progress in both fields in our group at Cinvestav - Mérida, focusing on four subjects: (i) advances in TiO_2 -based DSCs: performance as a function of film thickness and initial scale-up attempts; (ii) application of new dyes and redox couples in ZnO -based DSCs: sol-gel, CVD and electrodeposited ZnO ; (iii) WO_3 materials for the oxygen evolution reaction for tandem cells for direct photoelectrochemical water splitting; (iv) novel oxides for the hydrogen evolution reaction obtained from combinatorial methods.





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