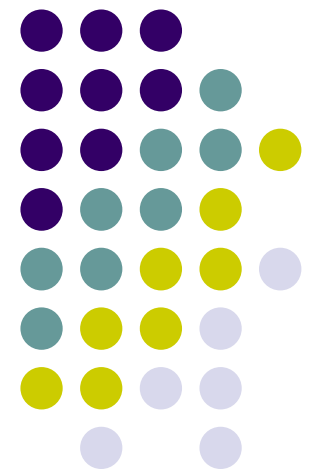
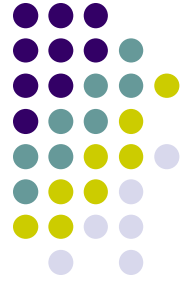




Dye-sensitized Solar cells



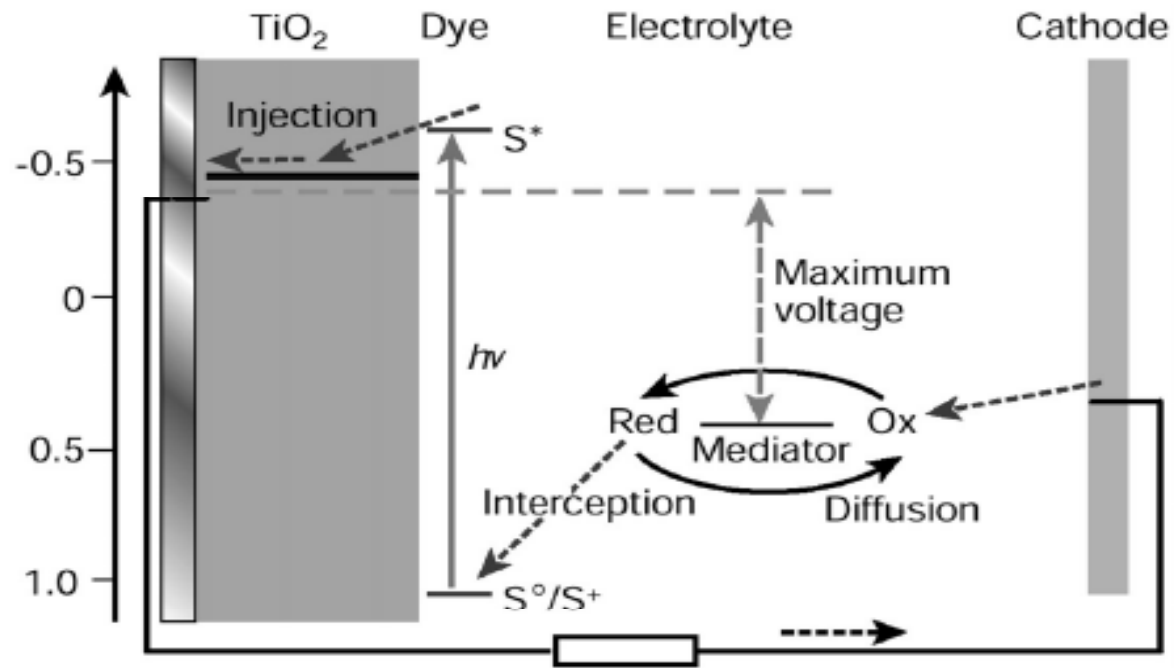
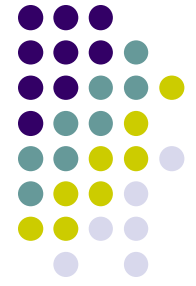
Tanja Ivanovska



1. Introduction

- Third generation thin film solar cells
- Low-cost manufacturing process
- Interconnected three-dimensional nanocrystalline structure
- Separation of the optical absorption and the charge separation process
- Invented by Michael Gratzel

2. Operation principle of the Dye-sensitized Solar Cell

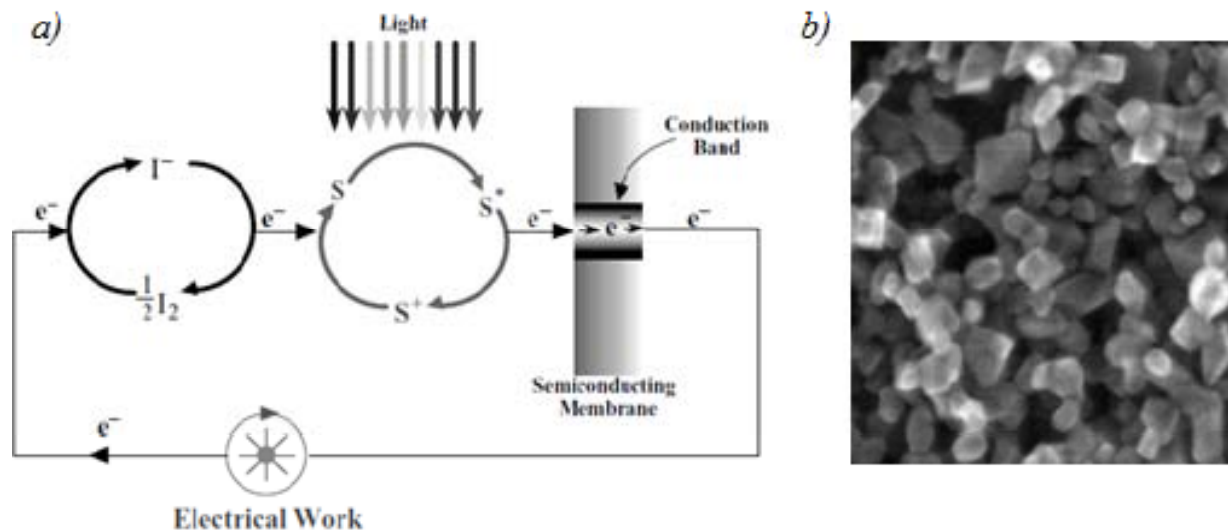


Energy band diagram of the DSC

2. Operation principle of the Dye-sensitized Solar Cell



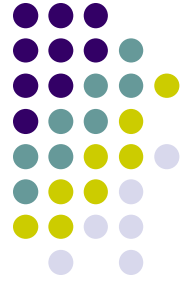
- Process of electricity generation
- Importance of nanostructure



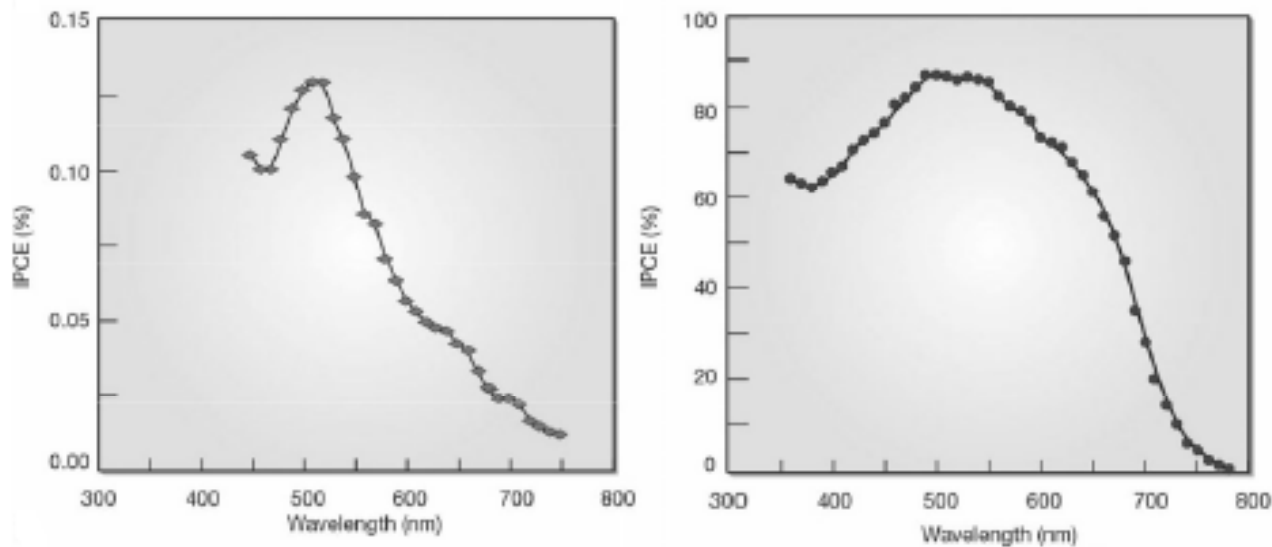
a) redox cycles in DSC

b) Transmission electron microscope picture of a TiO₂ (anatase) film

3. Photovoltaic performance of the dye-sensitized solar cell



- The IPCE value obtained with the single crystal electrode is only 0.13% near 530 nm, while it reaches 88% with the nanocrystalline electrode as shown



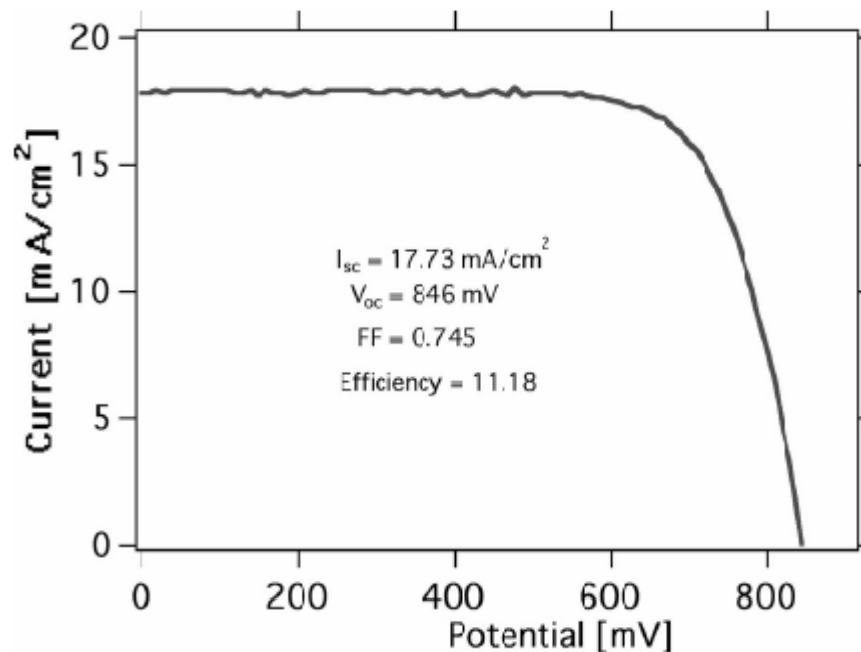
Conversion of light to electric current by DSC. Left: single crystal anatase. Right: nanocrystalline anatase film.

3. Photovoltaic performance of the dye-sensitized solar cell



- Conversion efficiency of the DSC

$$\eta = J_{sc} V_{oc} \frac{FF}{I_s}$$

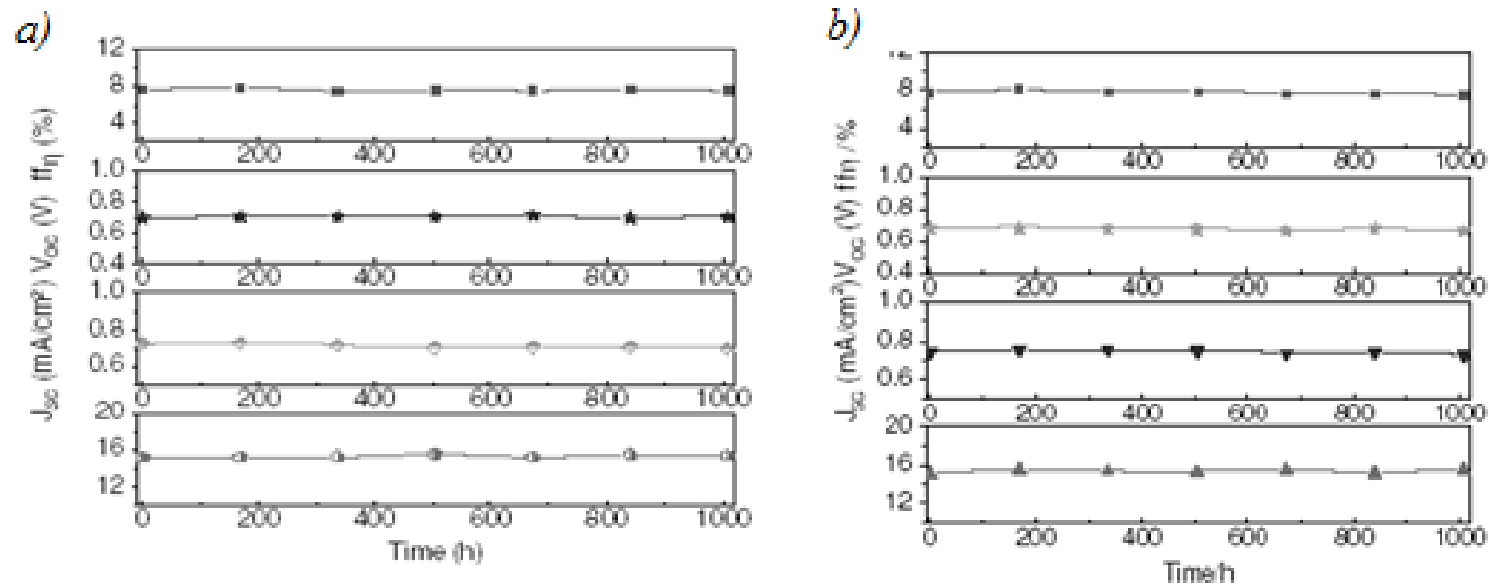


DSC with N-719 dye adsorbed on a double layer of nanocrystalline TiO₂ and scattering particles. The iodide/triiodide based redox electrolyte employed a mixture of acetonitrile and valeronitrile as a solvent in AM 1.5 sunlight

Photocurrent density versus voltage curve for a DSC



4. Experimental results

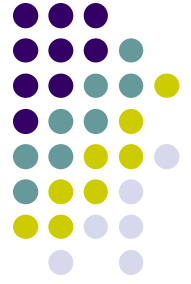


a) Temporal evolution of photovoltaic parameters (AM1.5 full sunlight) of the device during continued thermal aging at 80 °C in the dark; b) Temporal evolution of photovoltaic parameters (AM1.5 full sunlight) of the device during continued one sun equivalent visible light soaking at 60 °C.



5. Conclusion

- Inexpensive, abundant and non-toxic materials
- Low-cost manufacturing process
- Wide range of available colours and transparency
- Work in low illumination conditions and in diffuse light
- Appropriate for use in building integration



5. Conclusion

- Several companies promise market availability in near future
- 2009 - first ever commercial shipment
- Enormous potential of DSC
- Significant future renewable energy contributors

THANK YOU FOR YOUR
ATTENTION

