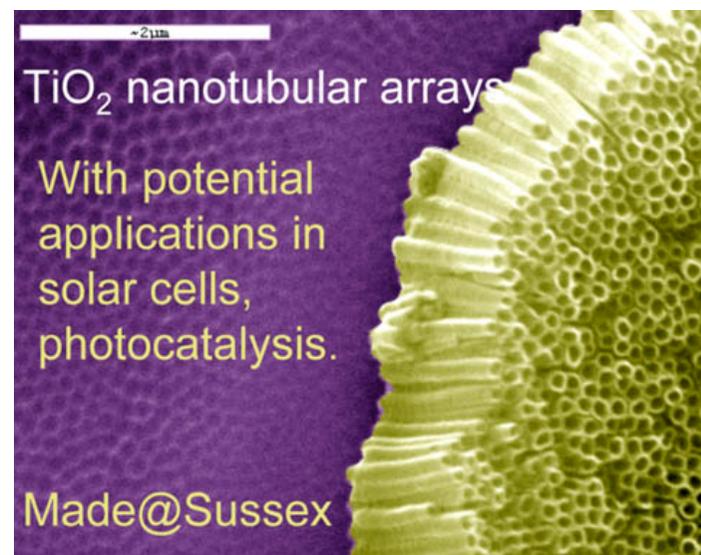
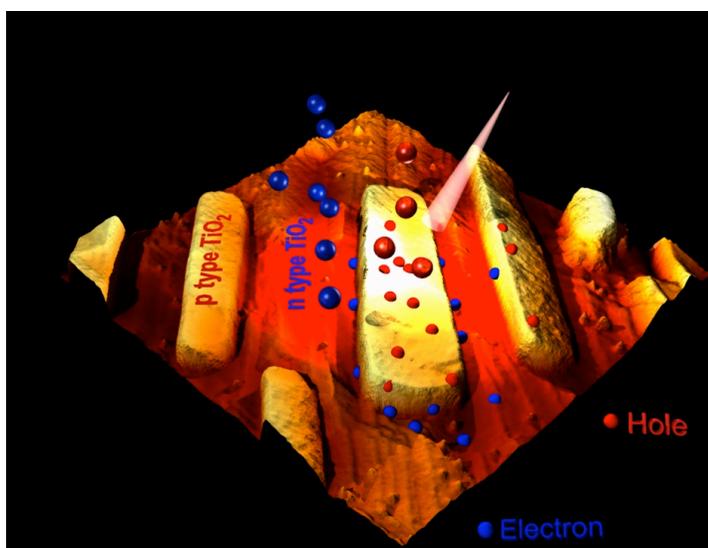


Creating Nanostructured Materials for Harvesting Solar Energy

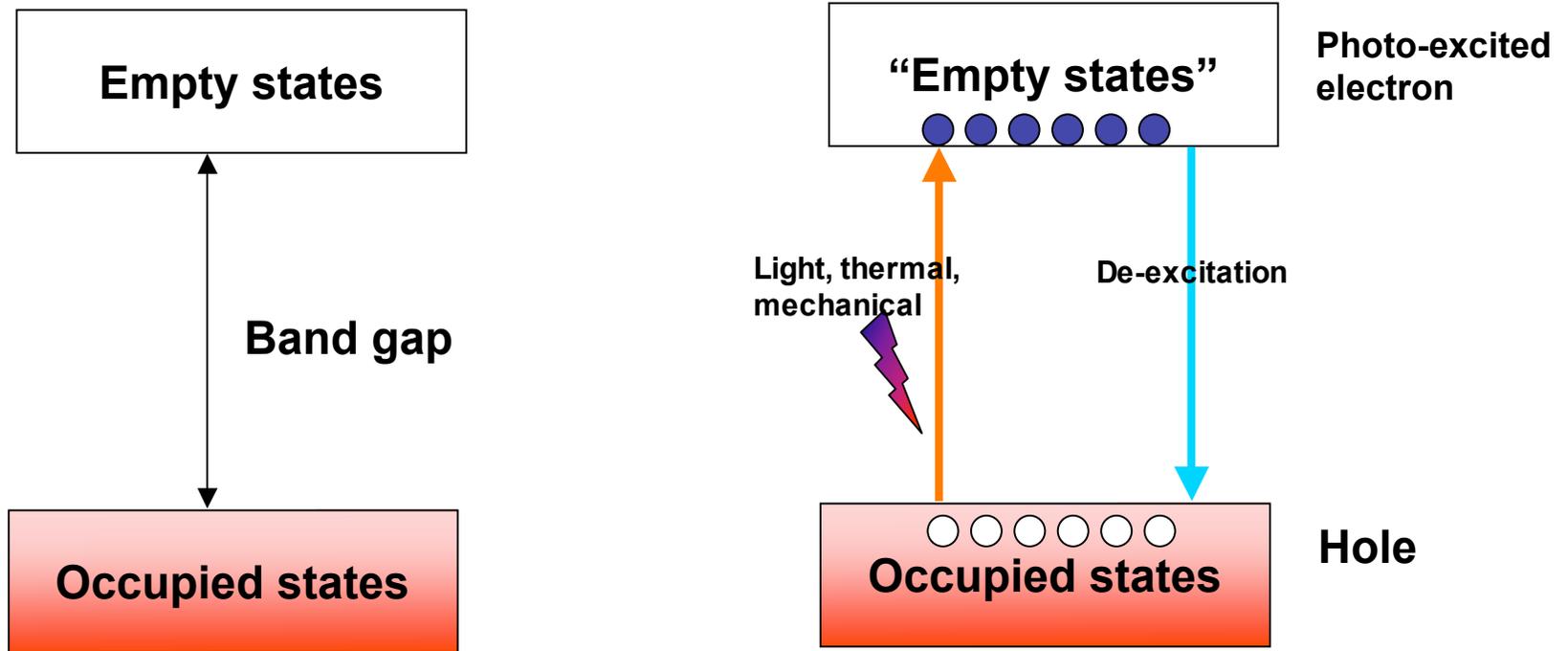
Dr. Qiao Chen



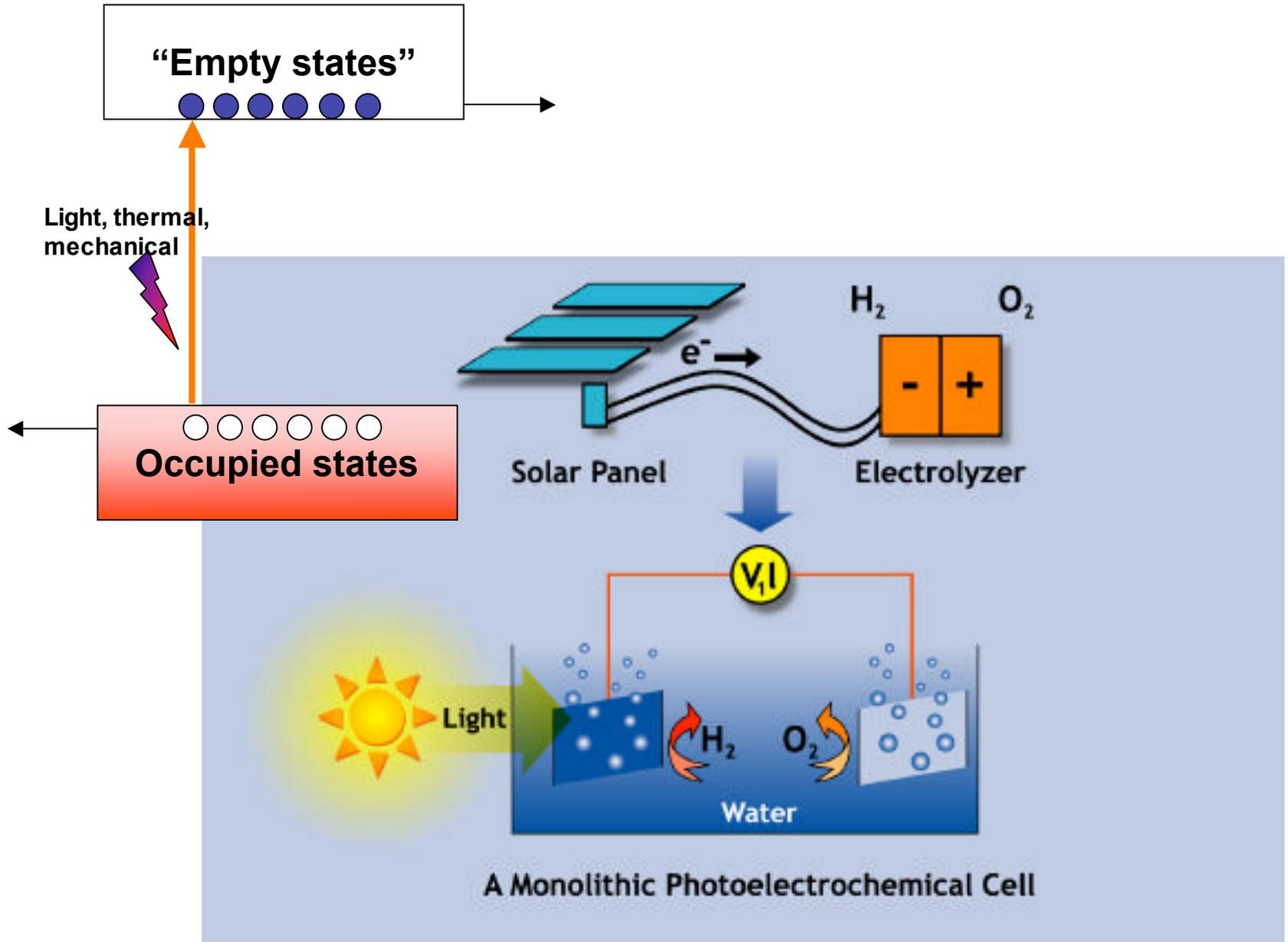
Email:Qiao.chen@sussex.ac.uk

<http://www.sussex.ac.uk/Users/qc25/>

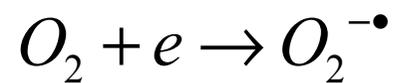
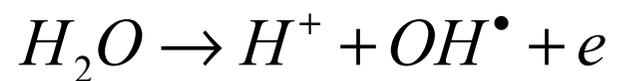
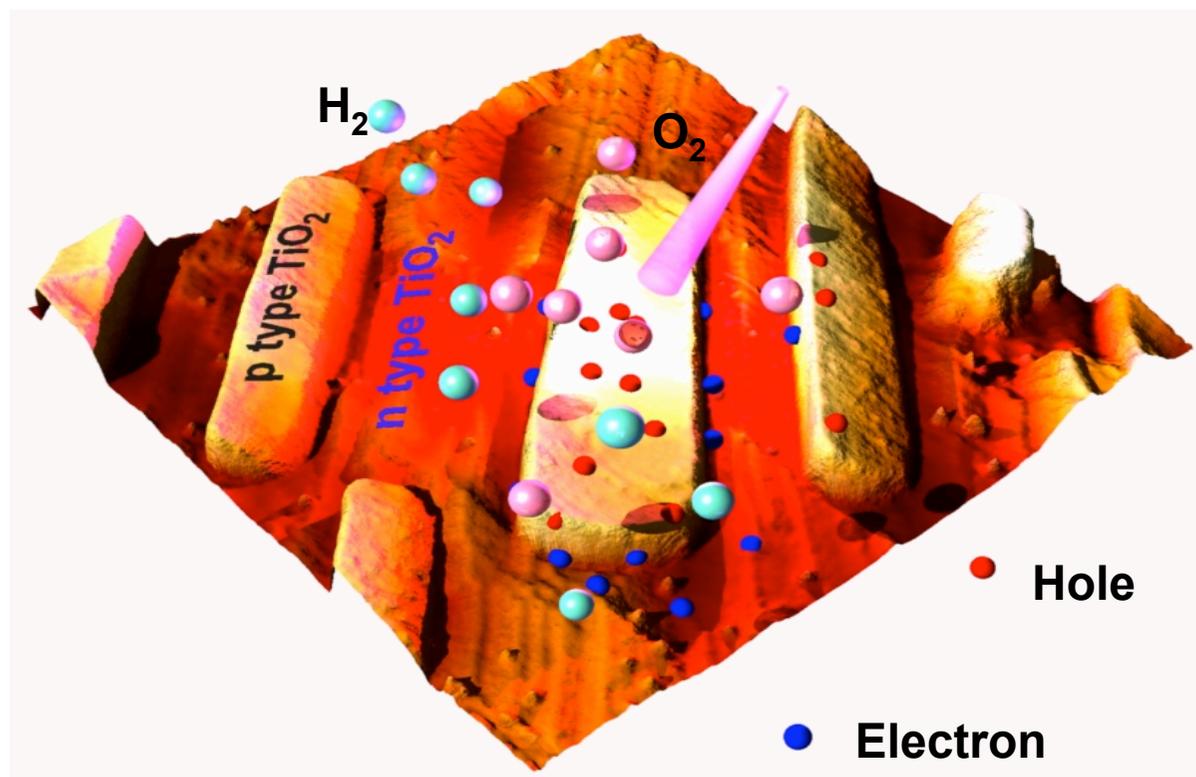
Semiconductor energy diagram and photoexcitation

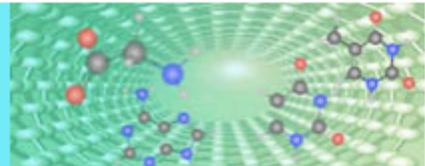


Energy transfer

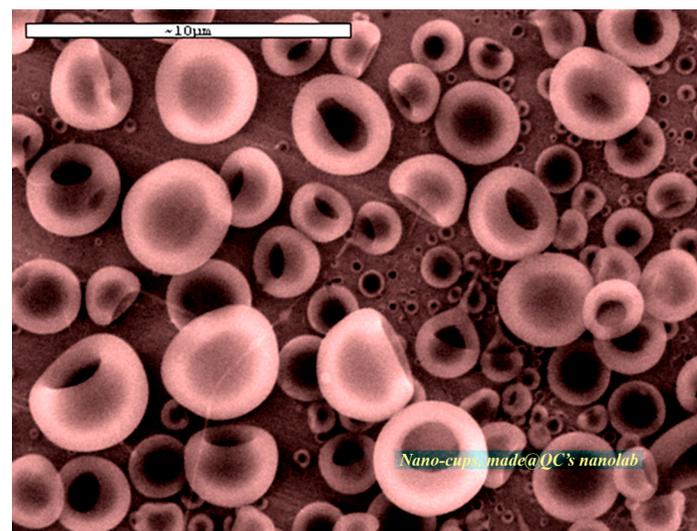
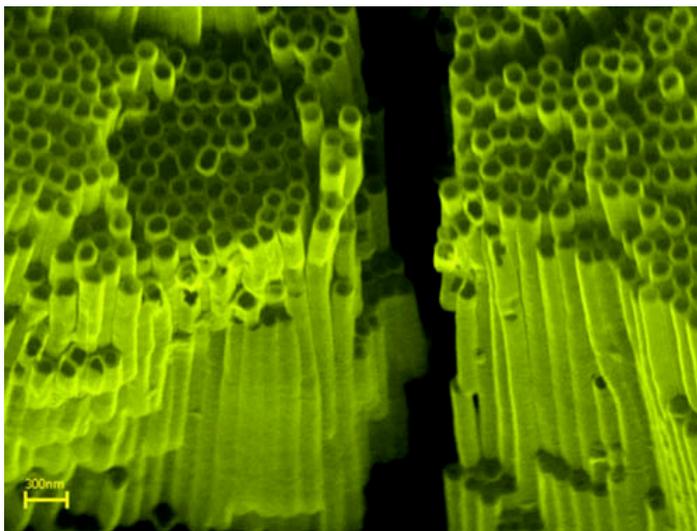
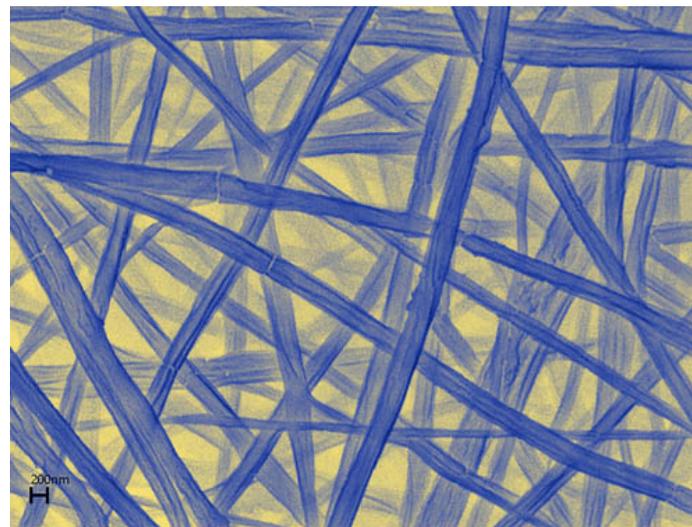
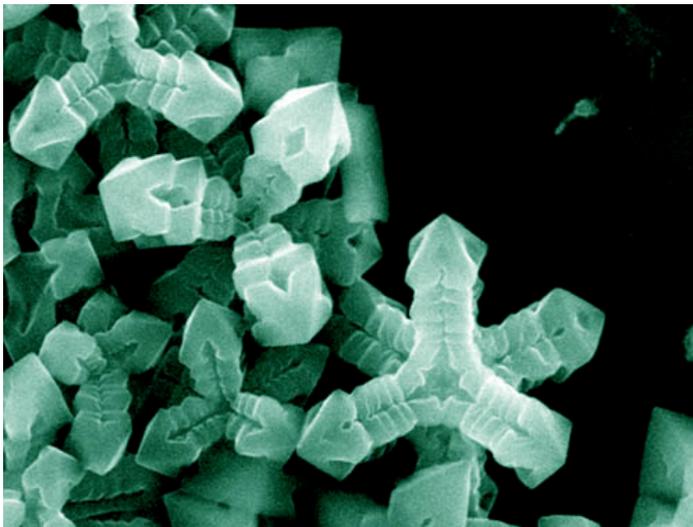


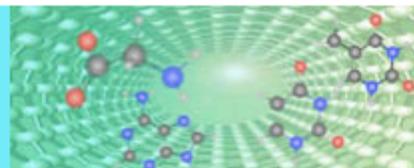
Nano pn junction=nano solar cells



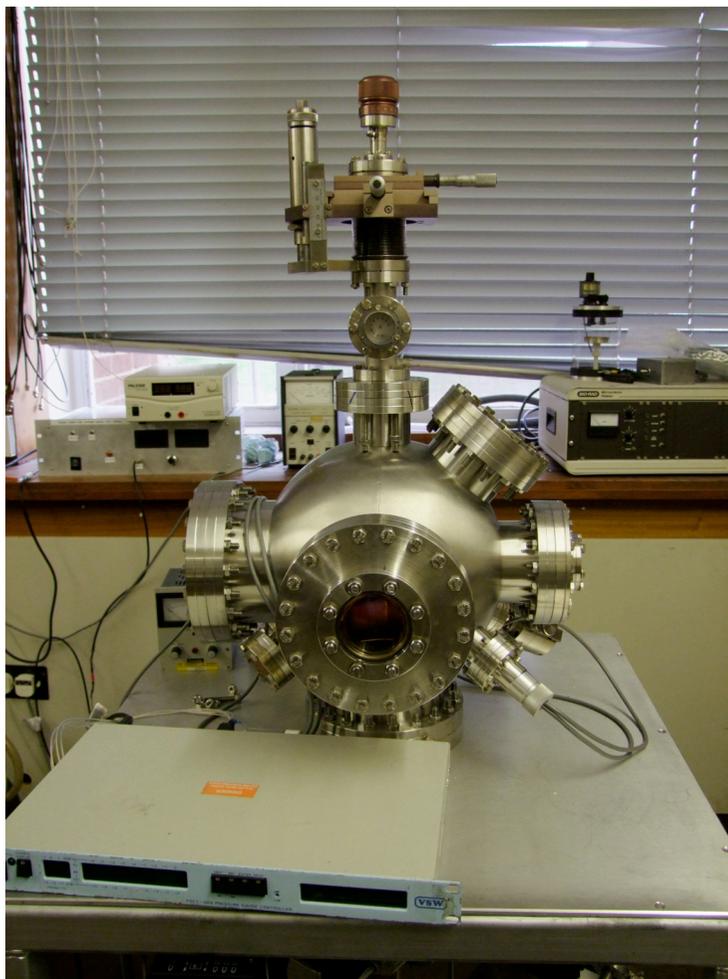


Creating Nanostructured materials-----crystals, tubes, fibres and cups





Methods of Creating Nanomaterials



Thin films:

1. UHV Thermal evaporation
2. Aerosol assisted CVD
3. Spin-on-Oxide

TiO₂ Nanotubes:

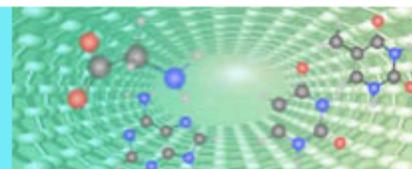
Anodisation

Nanofibres and cups:

Electrospinning

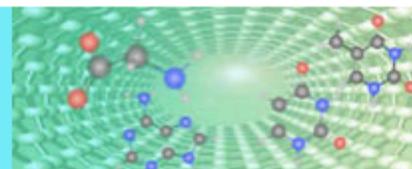
Metal Oxide Nanocrystals:

1. Hydrothermal
2. Electrochemical deposition



Application of nanomaterials in green energy

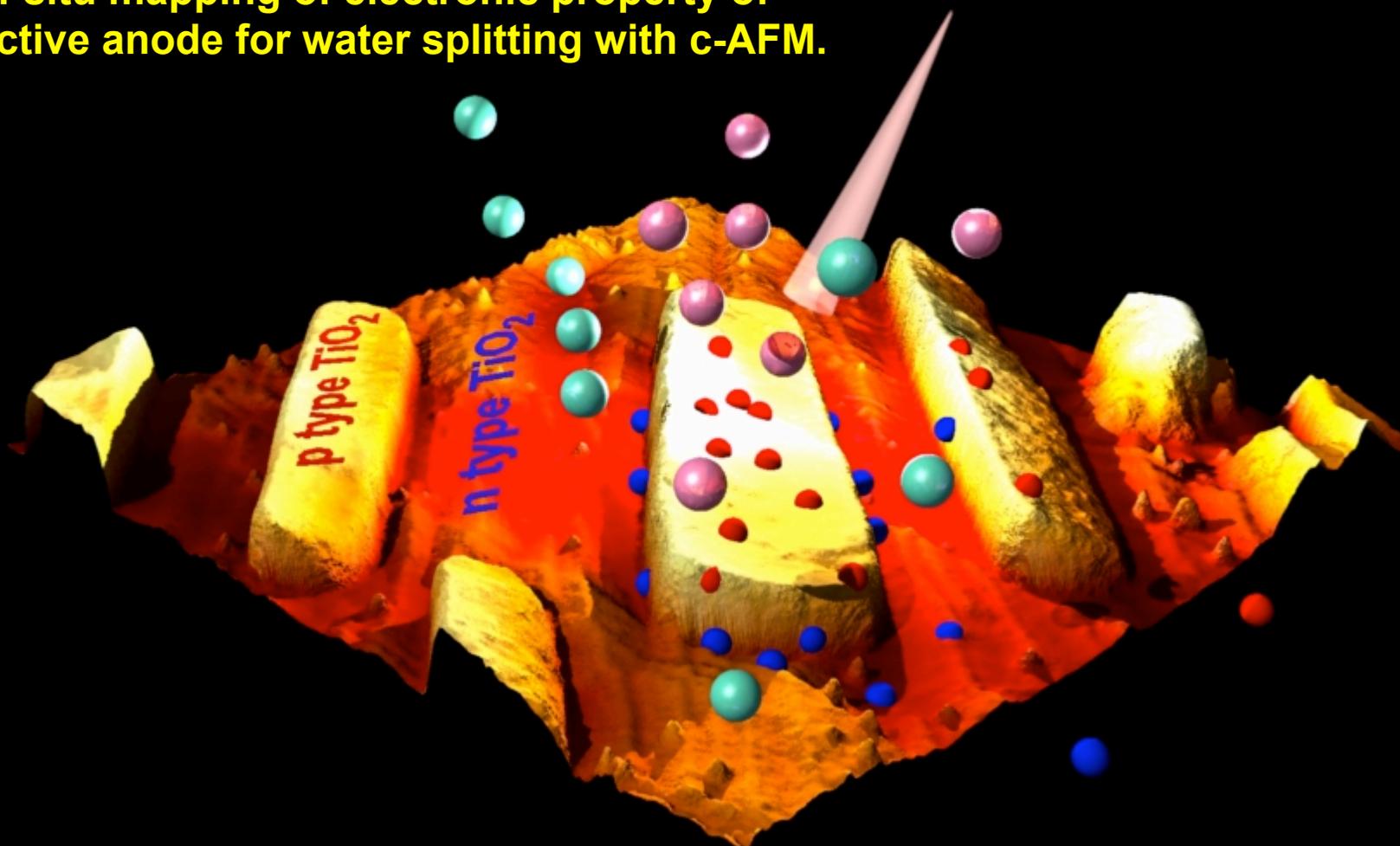
- ❖ **Solar cells**
- ❖ **Photoelectrolysis of water**
- ❖ **Photocatalytic formation of fuel**
- ❖ **Electrodes and electrolyte for ion batteries**
- ❖ **Energy conversion with piezo- and thermal-electric.**



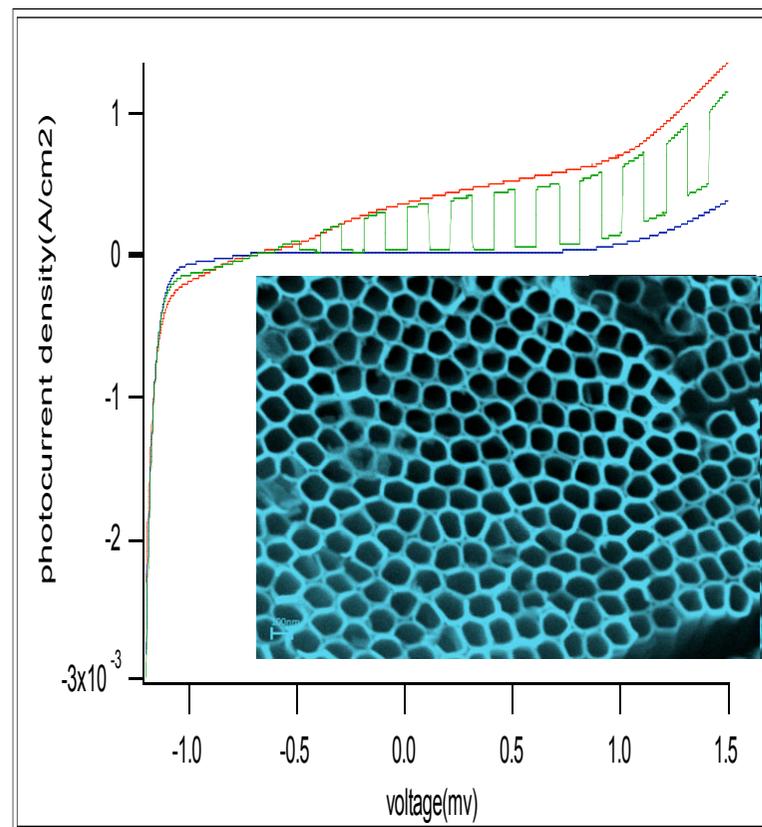
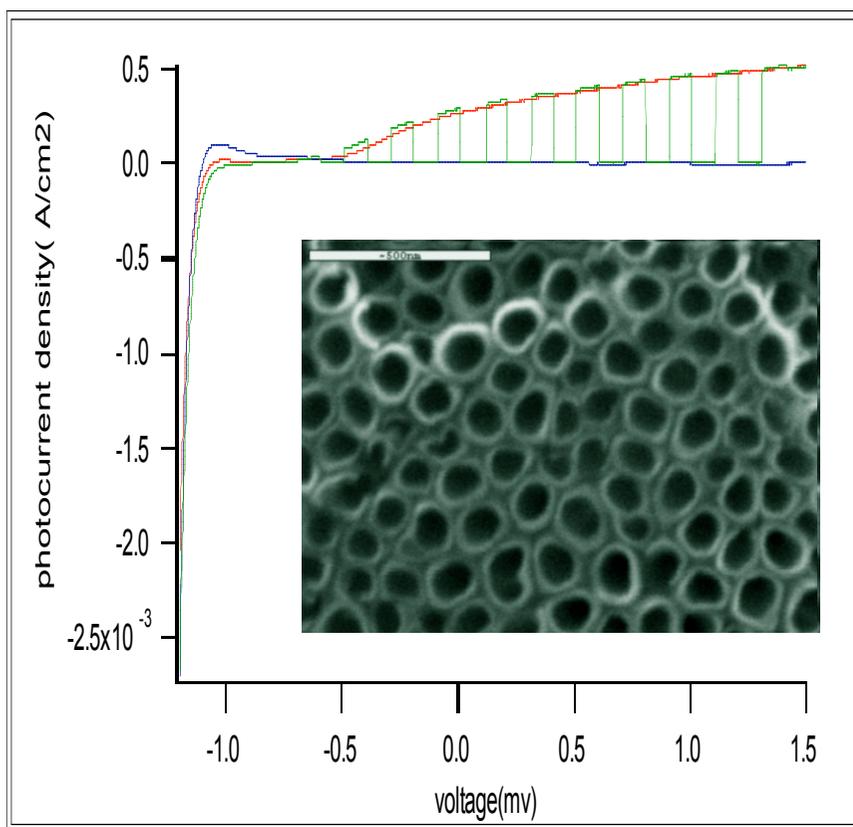
Veeco Labs Energy Innovation Grant (2010)

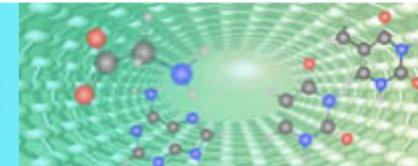
to enable advanced research in energy generation, storage and conversion.

**In-situ mapping of electronic property of
active anode for water splitting with c-AFM.**

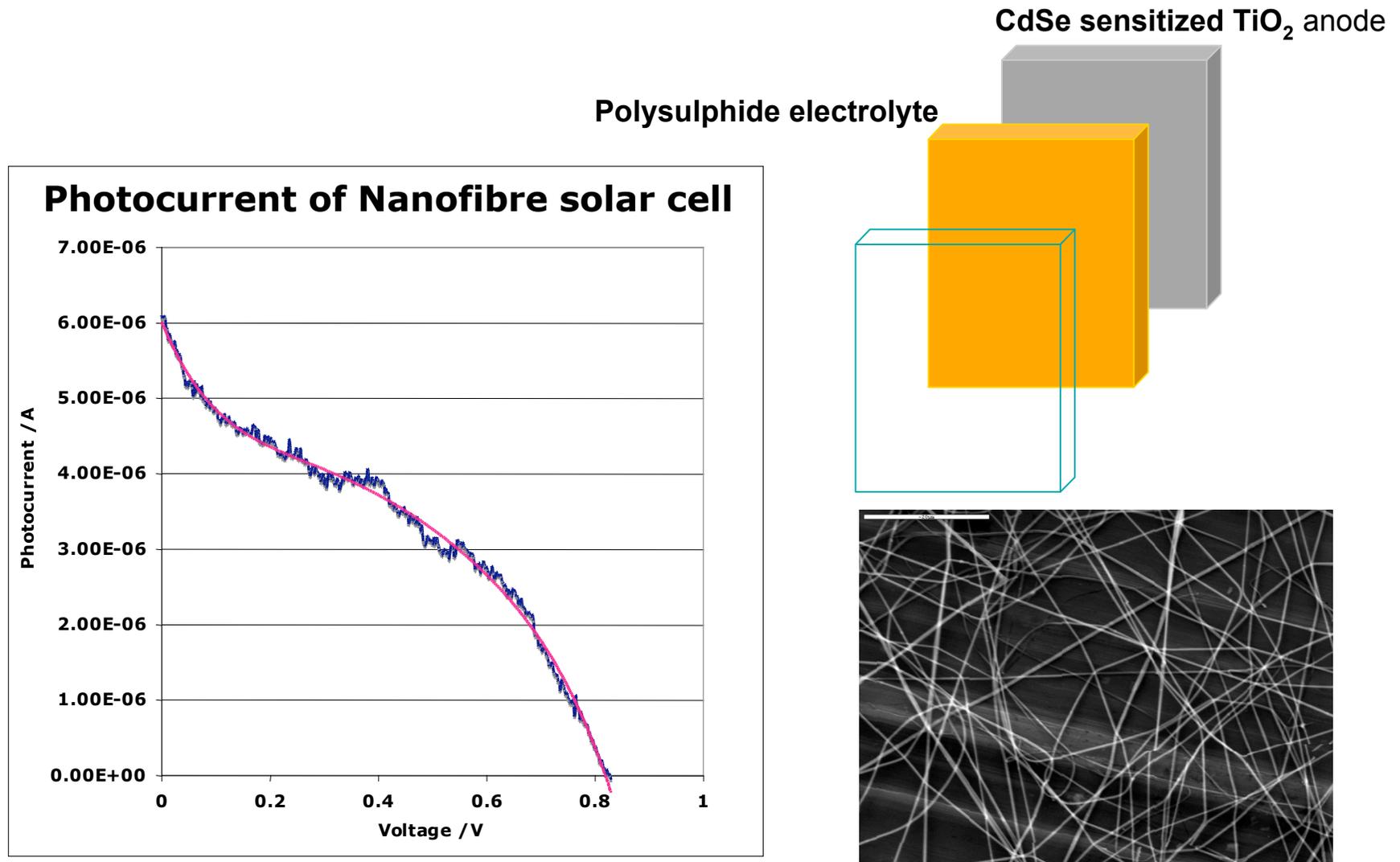


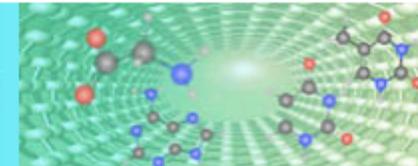
Example of applications: photoelectrolysis of water with TiO₂ nanotube anode





Example of applications: Solar cell with TiO₂ nanofibre anode

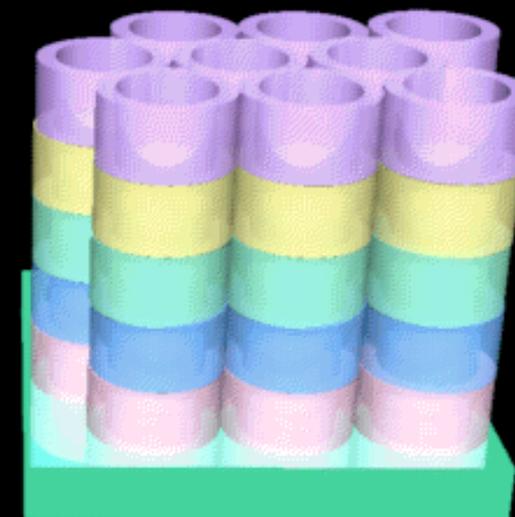
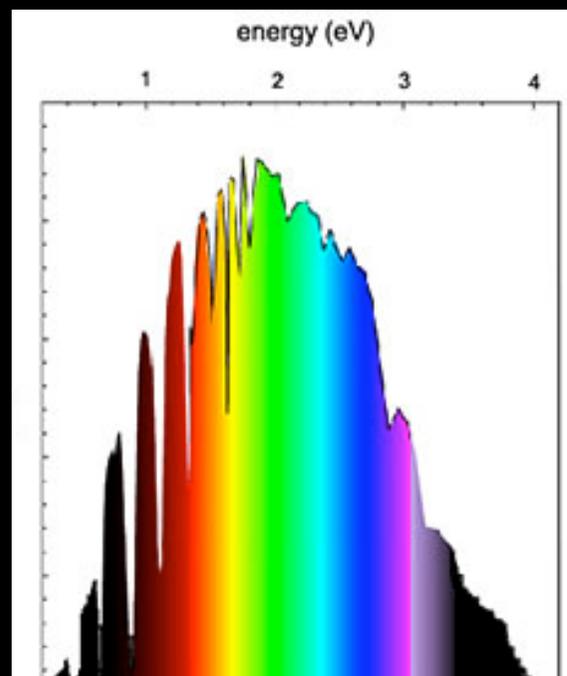
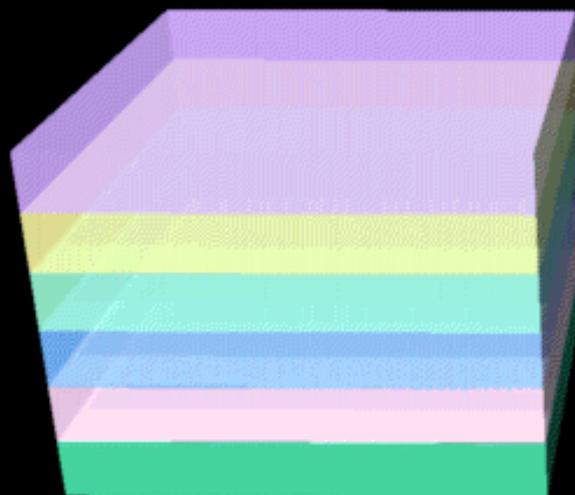




3D multilayer doped TiO₂ nanotubes

Create a rainbow

Solar spectrum



Improve light absorption

Research Team:

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Rantej Kler

Mabrouka Hemouda (Libyan government scholarship)

Daniel Lester (EPSRC CASE award)

Jasbir Badi (Commonwealth Scholarship)

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Dr. John Zhou (London South Bank Uni.)

Prof. Geoff Thornton (LCN, UCL)

Prof. Wuzong Zhou (St. Andrews Univ.)

Prof. N. V. Richardson (St. Andrews Univ.)

Dr. Ray Whitby (Brighton Univ.)

Dr. Christopher Perry (Loma Linda Univ.)