Chemical Engineering

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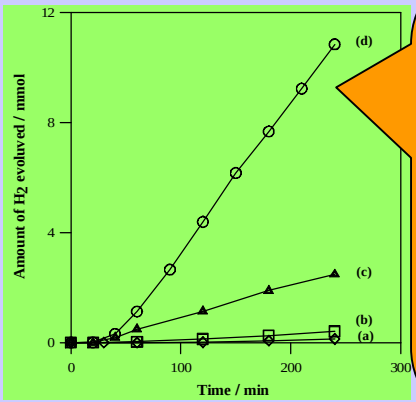
Research Interests:

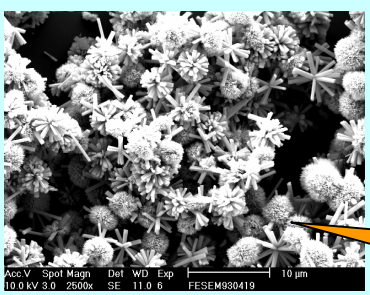
Development of High-Efficiency Photocatalysts for Hydrogen Generation from Water Splitting

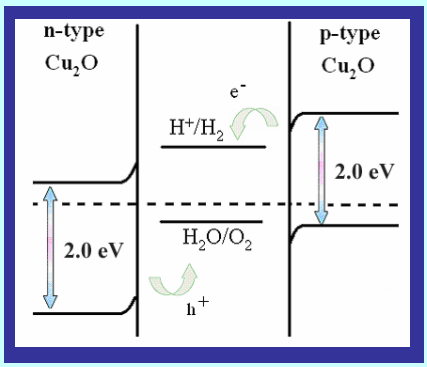
$NaTaO_3$ photocatalysts suspended in water under illumination

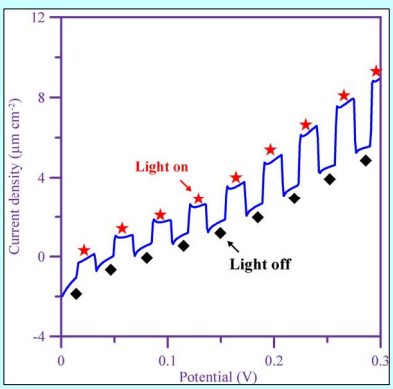


Photocatalytic H_2 evolution from pure water (900 ml) suspended with 2 g photocatalysts of solid-state $NaTaO_3$ (a), sol-gel $NaTaO_3$ (b), solid-state $NaTaO_3$-NiO (c), and sol-gel $NaTaO_3$-NiO (d). Light source: 400W high-pressure mercury lamp.

n- and p-type Cu_2O diode cells for water-splitting with visibe light







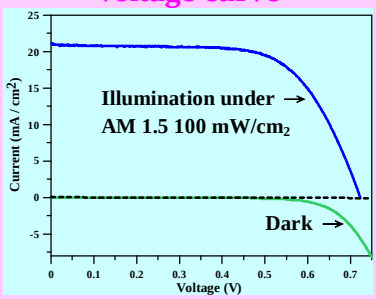
Cu_2O films from electrochemical deposition

Research and Development of Dye-sensitized Solar Cells

Dye-sensitized TiO_2 photovoltaic cells are lower in cost and higher in efficiency compared to the conventional semiconductor devices. To achieve the goal of effective light-to-electrical energy conversion, porous TiO_2 film would be the required structure for the electrode used.

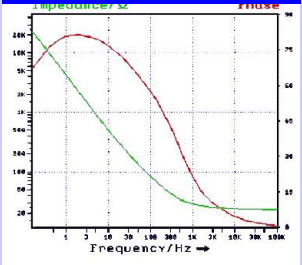
Dye-sensitized solar cells

Photocurrent versus voltage curve

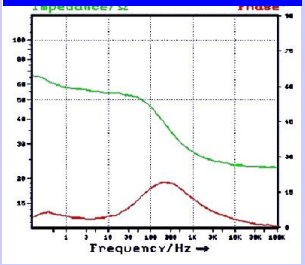


AC Impedance

Before Illumination

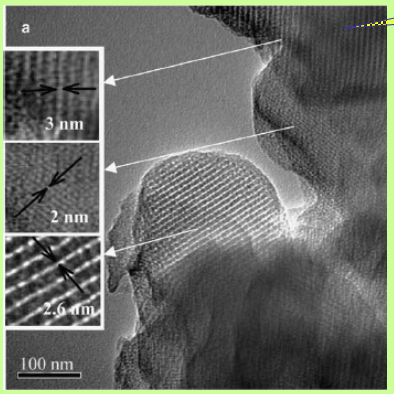


Under Illumination



Research and Development of Supercapacitors

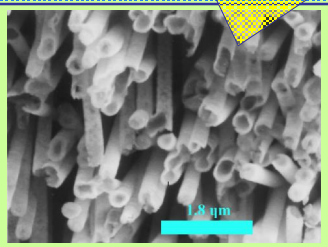
Mesoporous carbon and nickel-based tubule electrode arrays were prepared respectively using mesoporous silica and PC membrane as templates. The advantage is examined by using electrochemical double-layer charge and discharge in an aqueous solution.

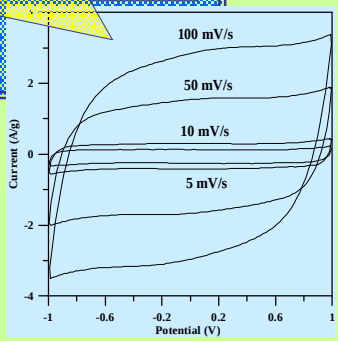


The TEM image of the meso porous carbon

Cyclic Voltammograms of the Carbon Electrode

The SEM image of the nickel based tubule electrode arrays





Studies on NO Reduction over Porous Materials-Supported Cu

Selective catalytic reduction (SCR) with NH_3 has been shown to be the most effective technique for NO control. Different support materials are employed, such as TiO_2 nanotubes, γ-Al_2O_3, MCM41, and highly order mesoporous carbon. Cu and other metal oxides are used as the active species and loaded using different techniques.

TiO_2 nanotubes prepared from hydrothermal treatment