Abstract #2579, 224th ECS Meeting, © 2013 The Electrochemical Society

Highly stable and efficient visible-light driven water photoelectrolysis system with use of nanocrystalline semiconducting oxides.

Renata Solarska, Krzysztof Bienkowski, Pawel J. Kulesza, Jan Augustynski
University of Warsaw, Faculty of Chemistry and Centre of New Technologies, Pasteura 1, 02-093 Warsaw, Poland
rsolarska@chem.uw.edu.pl

The nanostructured photoanodes, consisting of metal-oxide semiconductor materials such as Fe_2O_3, WO_3 , Fe_2WO_4-WO_3 or doped TiO_2, able to produce significant photocurrents under visible light illumination are used in photoelectrochemical devices as tri-dimensional films, with thickness in the range of microns, to insure both effective light absorption and charge transfer. Due to the large porosity of such films, the whole interparticle space is normally penetrated by the electrolyte. Hence, the efficiency of the nanostructured semiconducting oxide electrodes is controlled, on one hand, by the separation of photogenerated charge carriers and, on the other, by the electronic and ionic charge transport [1]. Such photoanodes might exhibit high chemical stability and resistance to the photocorrosion during the whole photoelectrolysis run, however, the choice of the suitable supporting electrolyte for water splitting, insuring ionic conductivity within the photoelectrochemical cell, is all than trivial [2]. Therefore, the behaviour of the nanostructured semiconducting photoanodes in different solutions, which allow one to obtain large, perfectly stable visible-light driven water splitting photocurrents, will be discussed. The important effect of the electrolyte concentration upon the current distribution and the related photocurrent losses within the nanoporous photoelectrodes will be also pointed out.

[1]. *To what extent do the nanostructured photoelectrodes perform better than their macrocrystalline counterparts?* Jan Augustynski and Renata Solarska, Catalysis Science& Technology: 10.1039/c3cy00056g

[2]. *A highly stable, efficient visible-light driven water photoelectrolysis system using a nanocrystalline WO_3 photoanode and a methane sulfonic acid electrolyte* Renata Solarska, Rafal Jurczakowski and Jan Augustynski, Nanoscale 4(2012), 1553