PO1031

# Deposition of hematite iron oxide thin photoanodes by reactive high power magnetron sputtering for photoelectrochemical water splitting

Stepan Kment[1], Zdenek Hubicka[2], Josef Krysa[3], Jiri Olejnicek[2], Martin Cada[2], Radek Zboril[1], Patrik Schmuki[4]

[1]Palacky University Olomouc, Olomouc, Czech Republic [2]Institute of Physics AS CR, Prague, Czech Republic [3]University of Chemistry and Technology Prague, Prague, Czech Republic [4]University of Erlangen-Nuremberg, Erlangen, Germany

stepan.kment@upol.cz

Iron oxide (α-$Fe_2O_3$) in hematite crystalline structure has been extensively examined for application to solar water splitting using photoelectrochemical cells due to its high chemical stability, nontoxicity, abundance, ability to absorb within the significant part of the solar spectra, and the low cost. We report on preparation of hematite thin films by means of reactive magnetron sputtering in several pulsing modes together with so called high power impulse magnetron sputtering (HiPIMS) regime. Three pulsing frequencies of the magnetron discharge including 100 Hz, 1 kHz with “on” time 100 ms and 50 kHz with “on” time 15 ms were investigated as well as the role of the substrate applied including Pt coated Si and fluorine doped tin oxide (FTO) substrates. It was revealed using Raman spectroscopy and XRD the superior role of the HiPIMS mode and Pt substrate on the PEC activity of the films fabricated, which was attributed to a high ion flux bombarding the substrate during the depositions. All the frequencies applied provided crystalline films with the hematite phase already during the coatings. For each particular pulsing frequency, however, a different orientation of crystallites was found, which was verified by Mössbauer spectroscopy. The films were also characterized using a broad range of methods (XRD, Raman spectroscopy, XPS, spectroscopic ellipsometry, AFM, SEM, etc.). The solar photocurrent measurements were done to assess the photoelectrochemical performances of the hematite electrodes.

**Keywords**
HiPIMS
hematite
photoelectrochemical water splitting
1D nanostructures
photoanode