APPLICATION OF INTENSITY MODULATED PHOTOCURRENT SPECTROSCOPY FOR PHOTOACTIVE MATERIAL CHARACTERIZATION

Ramūnas Levinas[1], Natalia Tsyntsaru[1,2], Henrikas Cesiulis[1]

[1] Faculty of Chemistry and Geosciences, Department of Physical Chemistry, Vilnius University, Lithuania
[2] Institute of applied physics of ASM, Moldova
ramunas.levinas@chf.vu.lt

Unlike in *Electrochemical Impedance Spectroscopy* (**EIS**), where the applied perturbation is commonly on the electrode potential, the *Intensity Modulated Photocurrent Spectroscopy* (**IMPS**) method works by modulating the illumination intensity by a pre-set amplitude (usually ~ 10% of total intensity) and frequency. For sufficiently photoactive materials, this results in a sinusoidal photocurrent response. Thus, as with EIS, by applying a transfer function the experimental parameters can be projected onto a complex plane as an IMPS spectrum. These spectra can then, in turn, be compared or interpreted to obtain key parameters of the material under investigation: charge transfer and carrier-hole recombination rate constants.

In this study we have prepared WO_3 films by electrodeposition from a peroxide-containing solution, at a potential of -0.45 V vs SCE, for different times. Another series of WO_3 films was prepared, but with incorporating TiO_2 nanoparticles during electrodeposition. All films were annealed at 450°C for 2 hours. The IMPS spectra were measured in 0.5M Na_2SO_4, under 100 W m^{-2} illumination intensity (365nm wavelength source), from 10 KHz to 0.1 Hz. Several differences were observed (see Fig. 1). Most notably the low-frequency intercept with the x-axis shifted closer towards 0 with the addition of TiO_2, which signifies a change in the recombination or charge transfer kinetics.

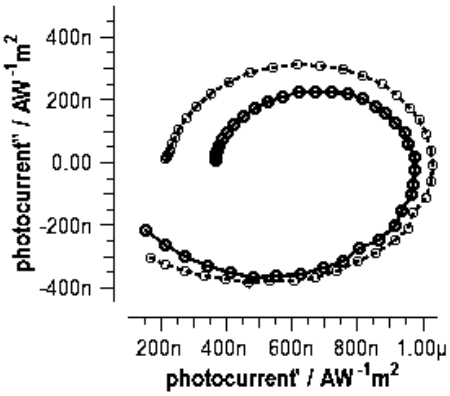

Fig. 1. IMPS spectra of WO_3 and WO_3 with TiO_2 films, electrodeposited for 10 minutes. Bias potential 1.0V vs Ag/AgCl.

Acknowledgement: authors acknowledge funding from H2020 project SMARTELECTRODES (No.778357) and by Research Council of Lithuania No 09.3.3-LMT-K-712-08-0003.