INFLUENCE OF SYNTHESIS TEMPERATURE ON THE PHOTOELECTROCHEMICAL PROPERTIES OF Cu_2O

Urte Rinkeviciute[1], Irena Savickaja[1], Monika Skruodiene[1,2], Arnas Naujokaitis[1], Vidas Pakstas[1], Anatolijs Sarakovskis[2], Milda Petruleviciene[1,2]

[1]Centre for Physical Sciences and Technology, Chemical engineering and technology, Lithuania
[2]University of Latvia, Institute of Solid-State Physics, Latvia
urte.rinkeviciute@ftmc.lt

Photoelectrochemical materials play an important role in converting solar energy into usable forms such as electricity or hydrogen fuel. Index Cu_2O is a promising semiconductor for these applications due to its absorption of visible light and low-cost synthesis; however, its stability and performance are often limited by photocorrosion and defect-related processes [1], [2]. Its photoelectrochemical properties are also highly sensitive to synthesis conditions, particularly the temperature used during electrode preparation [3]. The aim of this study was to evaluate the influence of synthesis temperature in the range of 30 - 80 °C on the photoelectrochemical properties of Index Cu_2O electrodes. Index Cu_2O electrodes were synthesized at different temperatures and characterized using open-circuit potential (OCP), cyclic voltammetry (CV), chronoamperometry (CA), electrochemical impedance spectroscopy (EIS).

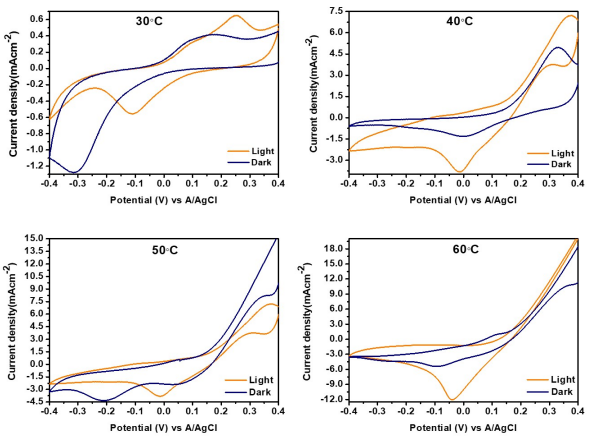

Fig. 1. CV responses of Index Cu_2O electrodes at various temperatures under light illumination (Orange) and in the dark (blue)

The CV results show a clear dependence of photoelectrochemical behavior on synthesis temperature (Fig. 1). Electrodes prepared at intermediate temperatures exhibited more stable open-circuit potentials, higher photocurrent responses, and lower charge transfer resistance, indicating improved interfacial charge transport. Investigation of temperature influence to the photoelectrochemical properties (OCP, CV, EIS and CA) will be presented and discussed in the conference.

Acknowledgements

The work of Milda Petruleviciene is supported by ERDF PostDoc project No. 1.1.1.9/LZP/2/25/232. Institute of Solid State Physics, University of Latvia has received funding from the European Union's Horizon 2020 Framework Programme H2020-WIDESPREAD-01-2016-2017-TeamingPhase2 under grant agreement No. 739508, project CAMART².

Keywords: Cu2O, photoelectrochemistry, electrochemical depositon;

[1] Q. Wang, Y. Zhang, and Y. Liu, "Photo Corrosion behaviour of CU2O nanowires during photoelectrochemical CO2 reduction," Journal of Electroanalytical Chemistry, vol. 912, no. 116239, pp. 1–7, 2022.
[2] C. Ying Toe, J. Scott, and R. Amal, "Recent advances in suppressing the photocorrosion of cuprous oxide for photocatalytic and photoelectrochemical energy conversion," Journal of Photochemistry and Photobiology C: Photochemistry Reviews, vol. 40, pp. 191–211, 2019.
[3] K. Syrek, M. Jażdżewska, and M. Kozieł, "Photoelectrochemical activity of CU2O electrochemically deposited at different temperatures," Journal of Industrial and Engineering Chemistry, vol. 115, pp. 561–569, 2022.