7th Baltic Electrochemistry Conference:

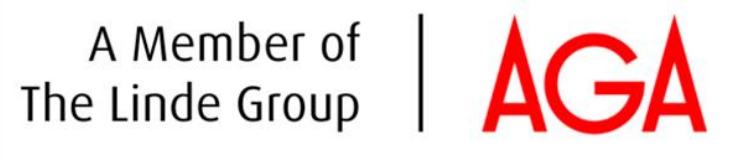
Finding New Inspiration

Tartu, Estonia

November 4-7, 2018

BOOK OF ABSTRACTS

We are very grateful to BEChem 2018 sponsors:



Welcome to Tartu, Estonia!

On behalf of the organizing committee, I am pleased to welcome you to the 7th Baltic Electrochemistry Conference: Finding New Inspiration (BEChem 2018).

Tartu is a fitting venue as the birthplace of 9 electrochemistry conferences "Electrical Double Layer and Adsorption at Solid Electrodes (1968-1991), and thereafter the Baltic Electrochemistry Conference series: the first (1996) and fifth meetings (2008) were also held in Tartu.

Tartu, a prestigious place of learning and science, is the home of the second oldest university in Northern Europe. Here world-leading scientists H. Hess, W. Ostwald, and G. Tamman studied and developed modern physical chemistry, electrochemistry and materials science.

BEChem 2018 brings together scientists, engineers and young researchers from academia, infrastructure facilities, industry and government institutions to share results and discuss issues related to various fields of fundamental and applied electrochemistry, sustainable energetics, materials science, bio- and photoelectrochemistry.

This conference provides an opportunity to learn and exchange information and know-how on the latest scientific and technical developments related to devices for sustainable energetics, including hydrogen storage devices, solid oxide and polymer membrane fuel or electrolysis cells, Li- and Na-ion batteries, supercapacitors, hybrid capacitors as well as photovoltaic and bioelectrochemical systems.

The conference is expected to draw nearly 170 experts, researchers and company representatives from 31 countries all around the world, involved in different fields of electrochemistry and materials science, especially novel *operando* measurement methods conducted at neutron beam and synchrotron radiation facilities.

Please use this meeting and the conference website (http://BEChem2018.ut.ee/) to make the most of your time for the future development of a sustainable and cleaner environment.

We thank you for the participation and support of the Baltic Electrochemistry Conference.

On behalf of the BEChem2018 organizing committee,

Professor Enn Lust

Wednesday 07.11.2018		
9:00 - 9:45	Keynote: **Dr. S.C. Singhal** "Solid Oxide Fuel Cells For Clean and Efficient Power Generation" Pacific Northwest National Laboratory, USA Session chair: Prof. Dr. M.B. Mogensen	
10:00	Room 1	Room 2
	Solid Oxide Fuel Cells Session chair: Prof. Dr. M.B. Mogensen	Bioelectrochemical Processes and Novel Devices Session chair: Prof. E. Lust
	Mr. R. Kanarbik "Application of SIMS for Analysis of Solid Oxide Materials and Devices" Institute of Chemistry, University of Tartu, Estonia	**Mr. K. Dharmaraj** "The Electrochemistry of DPPH for ion transfer in three phase electrode system" Institut für Biochemie, Universität Greifswald, Germany
10:20	**Mr. O. Korjus** "*Operando* characterization of crystallographic and electrochemical properties of Ni-$Ce_{0.9}Gd_{0.1}O_{2-\delta}$ solid oxide fuel cell anode" Institute of Chemistry, University of Tartu, Estonia	**Ms. V. Buk** "New Nanomaterial-Based, Microfabricated, Miniaturised Electrochemical Sensors for the Detection of Glucose" Tyndall National Institute; University College Cork, School of Chemistry, Ireland
10:40	**Mr. M. Shahid** "Nickel-Ceria Impregnated Lanthanum Doped Strontium Titanate Anodes using 3-Electrode Configuration for Methane based SOFC" Department of Chemical Engineering, IIT Delhi, India	**Ms. A. Krittayavathananon** "Improving Single Carbon Nanotube Electrode Contacts Using Molecular Electronics" Department of Chemistry, Physical and Theoretical Chemistry Laboratory, University of Oxfod, United Kingdom; Department of Chemical and Biomolecular Engineering, School of Energy Science and Technology, Vidyasirimedhi Institute of Science and Technology, Thailand
11:00	**Coffee break**	
	Session chair: Dr. G. Nurk	Session chair: Prof. E. Lust
11:20	**Dr. M. Osial** "Studies of photoelectrochemical hehaviour of dropcasted and Langmuir-Blodgett layers of CdS nanoparticles" Faculty of Chemistry, University of Warsaw, Poland	**Dr. I. Voroshylova** "Differential Capacitance at Au(*hkl*)–[BMIm][PF_6] interface: the Influence of Electrode Crystallography" Faculdade de Ciências, Universidade do Porto, Portugal
11:40	**Mr. M. Rozman** "Novel electrode positioning geometric approach in photocell construction based on existing Dye-sensitezed solar cells (DSSC)" Faculty of Chemistry and Chemical Technology, Slovenia	**Ms. F. Summer** "Modeling of Electrochemical flow capacitor (EFC) design using Finite element method (FEM)" Institute of Technology, University of Tartu, Estonia
12:00	**Dr. L. Suhadolnik** "Synthesis and characterization of novel TiONIr electrocatalyst for oxygen evolution reaction" Department for Nanostructured Materials, Jožef Stefan Institute, Slovenia	**Mr. K. Avchukir** "Electrodeposition of indium from betainium bis- (trifluoromethylsulfonyl)imide ionic liquid" Al-Farabi Kazakh National University, Center of Physical Chemical Methods of Research and Analysis, Kazakhstan
12:20	**Prof. R. Doong** "Boron and Nitrogen Doped Graphene Quantum Dot Based Nanocomposites for Energy Storage Device Applications" Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Taiwan	**Dr. H. Kahlert** "Determination of Stress Factors to which Plants were exposed during their Growth using Voltammetric and Chemometric Methods" Universtity of Greifswald, Germany
12:40 - 14:00	**Lunch**	
14:00 - 14:45	Keynote: **Prof. Dr. M.B. Mogensen** "Research and Development of Solid Oxide Electrolysis Cells – Status and Perspectives" Department of Energy Conversion and Storage, Technical University of Denmark, Denmark Session chair: Dr. S.C. Singhal	
15:00	Room 1	Room 2
	High-Temperature Electrolysis Session chair: Dr. S.C. Singhal	Low- and High-Temperature Corrosion Session chair: Dr. S. Kallip
	Dr. R. Küngas "Perspectives on the electrification of the chemical industry" Haldor Topsoe A/S, Denmark	**Prof. Dr. R. Ramanauskas** "Active Corrosion Protection of Steel by Oxygen Containing Conversion Films" Center for Physical Sciences and Technology, Lithuania
15:20	**Mr. R. Sankannavar** "High Oxygen Evolution Reaction Activity on Lithiated Nickel Oxides" Department of Chemical Engineering, Indian Institute of Technology Bombay, India	**Ms. G. Rakhymbay** "Highly effective corrosion inhibitor of steel in a chloride-containing medium" Al-Farabi Kazkazh National University, Kazakhstan
15:40	**Coffee break**	
	Session chair: Dr. O. Oll	Session chair: Prof. Dr. R. Ramanauskas
16:00	**Dr. J. Juodkazytė** "Selectivity of Nickel Oxide Anode towards Oxygen Evolution Reaction in Alkaline Chloride Medium" Center for Physical Sciences and Technology, Lithuania	**Dr. V. Sammelselg** "Stainless steel corrosion protection with thin nanocomposite corrosion resistive coatings" Institute of Physics, University of Tartu, Estonia
16:20	**Dr. I. Oja Acik** "Titania thin films as an effective photocatalyst for air purification" Laboratory of Thin Film Chemical Technologies, Department of Materials and Environmental Technology, Tallinn University of Technology, Estonia	**Mr. V.M. Kanamarlapudi** "Electrochemical Measurements for Corrosion and their Reliability" Physical Sciences RA, Tata Research Development and Design Centre, Tata Consultancy Services Ltd., India
16:40	**Dr. A. Sarapuu** "Electroreduction of Oxygen on Fe- and Co-Containing Nitrogen-Doped Nanocarbons" Institute of Chemistry, University of Tartu, Estonia	**Dr. S. Kallip** "3D resolved Scanning Vibrating Electrode Technique for observation of localized ionic currents in corrosion research" Institute of Chemistry, University of Tartu, Estonia; CICECO Aveiro Institute of Materials, University of Aveiro, Portugal
17:00		
17:30	**Chemicum and sauna**	

Electrodeposition of indium from betainium bis-(trifluoromethylsulfonyl)imide ionic liquid

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High-purity indium is in demand in the production of many useful metal alloys and semiconductors, such as Ag-In, Ni-In, In-As and In-Sb. The most complete review of the electroreduction of indium on various electrodes is given in [1] and basic electrochemistry of indium reviewed by Piercy et al. and Losev. Low temperature ionic liquids (IL) are a new class of non-aqueous solvents considered as promising electrolytes for electrochemical deposition (ECD) of high-quality indium films [2-4]. But, studies on the electrochemistry of indium in low-temperature IL are very limited. And works devoted to ECD of indium from betainium bis-(trifluoromethylsulfonyl) imide ([Hbet][Tf_2N]) IL completely absent. In literature [5] showed for the first time that [Hbet][Tf_2N] IL can be used for homogeneous liquid−liquid extraction of In^{3+} ions with high selectivity. This makes [Hbet][Tf_2N] IL attractive for use as a selective electrolyte in the electrorefining of rought indium. Another important advantage of this IL is its ability to regenerate, as well as air- and water-stability.

The electrodeposition of indium was studied with voltammetry and chronoamperometry at glassy carbon electrode (produsedby Metrohm) from [Hbet][Tf_2N] IL solution containing 0.1 mol l^{-1} [$Inbet_3$][Tf_2N]$_3$ at 80^{o}C. All electrochemical experiments were performed in a three-electrode electrochemical cell using a potentiostat/galvanostats Bio-Logic VSP 300. Dried [Hbet][Tf2N] and [$Inbet_3$][Tf_2N]$_3$ salt was prepared using a literature method [6]. The experiments were performed varying scan rate (5–160 mVs^{-1}) and overpotential. The kinetic parameters of nucleation were evaluated through a Scharifker-Hills model. The indium deposits were characterized by X-ray diffraction and scanning electron microscopy techniques.

At E = –0.4 V cathode current is not observed; at E= –0.5 V the cathodic current density increases as the new nuclei are formed. After having reached a maximum (j_{max} = –3.20 mA cm^{-2}, t_{max} = 1.75 s) the cathodic current decreases towards the limiting diffusion current. The diffusion coefficient of In^{3+} ions determined from cyclic voltammetry by the Randles-Sevcik equation is in good agreement with the value determined from potentiostatic measurements using the Cottrell equation (5.86×10^{-7} cm^2s^{-1}). The analysis of current transients, using theoretical nucleation models, showed that the electrodeposition of indium adjusts to a three-dimensional nucleation under progressive nucleation limited by diffusion. It is found that with increasing polarization the nucleation rate and the number density of active sites increase. This leads to a decrease in the average grain radius of the electrodeposited indium. The formation of dense deposits is confirmed by the results of SEM analysis. The EDX analysis confirmed the presence of indium.

References

[1] Y.H. Chung, C.W. Lee, Electrochemical behaviors of Indium, J. Electrochem. Sci. Technol. 3 (2012) 1–13

[2] M.H. Yang, I.W. Sun, Electrochemical Study of Indium in a Water-Stable 1-Ethyl-3-Methylimidazolium Chloride/Tetrafluoroborate Room Temperature Ionic Liquid, J. Chinese Chem. Soc. 51 (2004) 253–260

[3] Y. Traore, S. Legeai, S. Diliberto, G. Arrachart, S. Pellet-Rostaing, M. Draye, New insight into indium electrochemistry in a Tf2N-based room-temperature ionic liquid, Electrochim. Acta. 58 (2011) 532–540

[4] S. Zein El Abedin, A.Y. Saad, H.K. Farag, N. Borisenko, Q.X. Liu, F. Endres, Electrodeposition of selenium, indium and copper in an air- and water-stable ionic liquid at variable temperatures, Electrochim. Acta. 52 (2007) 2746–2754

[5] T. Vander Hoogerstraete, B. Onghena, K. Binnemans, Homogeneous liquid–liquid extraction of metal ions with a functionalized ionic liquid, The journal of physical chemistry letters. 4(2013) 1659-1663

[6] P. Nockemann, B. Thijs, S. Pittois, J. Thoen, C. Glorieux, K. Van Hecke, K. Binnemans, Task-specific ionic liquid for solubilizing metal oxides, The Journal of Physical Chemistry B, 110(2006), 20978-20992