PhD STUDIES COURSE UNIT DESCRIPTION

Name of subject	Field of science, code	Faculty / Center	Department
Solutions of Electrolytes	Chemistry N 003	Chemistry and Geosciences	Physical Chemistry
Student's workload	**Credits**	**Student's workload**	**Credits**
Lectures		Consultations	
Independent study	7	Seminars	

Course annotation
This course deals with the specific types of chemical systems and the equilibrium associated with electrolyte solutions. The thermodynamics of electrolyte solutions is important in the study of many chemical systems, such as acid-base chemistry, bioelectrochemical, chemical processes and reactions. Ionic equilibrium in electrolyte solutions is analyzed: weak electrolytes, amphoteric electrolytes, electrolyte mixtures, complex electrolytes, its description, ionic composition calculation methods. Introduction to programs that can be applied to equilibrium calculations (Maple6, Matematica, etc.). The activity of electrolytes, Debay-Hiuckel theory, Robinson-Stokes theory, their application to the methods of estimating the influence of ionic strength on the effective values of equilibrium constants and rate constants are analyzed in detail. Purbe diagrams, their analysis and application in analytical chemistry, electrochemistry, geoscience and environmental studies, predicting electrodeposition and corrosion properties of metals are analyzed. Transfer phenomena in electrolyte solutions are widely studied: electrolyte conductivity, diffuse, migratory, convectional transfer and laminar flow.
Reading list
1. A. Survila. Electrochemistry of Metal Complexes Applications from Electroplating to Oxide Layer Formation. Weinheim, Germany, Wiley-VCH, 2015, 304 p. 2. V. Bagotsky. Fundametals of Electrochemistry, 2005 3. Ch. M.A. Brett, A.M.O. Bret. Electrochemistry, principles, methods and applications, 2005. 4.. J. O'M. Bocris, A.K.N. Reddy.Modern Electrochemistry. Ionics., 1998. 5. John O'M. Bockris, Amulya K.N. Reddy. Modern Electrochemistry 2B: Electrodics in Chemistry, Engineering, Biology and Environmental Science, 2001

The names of consulting teachers	Science degree	Main scientific works published in a scientific field in last 5 year period
Prof. Henrikas Cesiulis	Dr.	1. R. Levinas, N.Tsyntsaru, **H. Cesiulis**. The Characterisation of Electrodeposited MoS_2 Thin Films on a Foam-Based Electrode for Hydrogen Evolution. *Catalysts*, 2020, 10 (10), art. 1182. 2. M. Vainoris, **H. Cesiulis**, N. Tsyntsaru. Metal Foam Electrode as a Cathode for Copper Electrowinning. ***Coatings*** 2020, 10, 822; doi:10.3390/coatings10090822 3. E. Vernickaite, N. Tsyntsaru, K. Sobczak, **H. Cesiulis**. Electrodeposited tungsten-rich Ni-W, Co-W and Fe-W cathodes for efficient hydrogen evolution in alkaline medium. *Electrochimica Acta* 318 (2019) 597-606. https://doi.org/10.1016/j.electacta.2019.06.087 4. R. Levinas, N.Tsyntsaru, **H. Cesiulis**. Insights into electrodeposition and catalytic activity of MoS_2 for hydrogen evolution reaction electrocatalysis, *Electrochimica Acta* 317 (2019) 427-436. **DOI:** 10.1016/j.electacta.2019.06.002

		5. T. Maliar, **H. Cesiulis**, E.J. Podlaha. Coupled electrodeposition of Fe-Co-W alloys: Thin films and nanowires. *Frontiers in Chemistry* 7 (2019), Article No. 572, 11 p., **DOI:** 10.3389/fchem.2019.00542 6. E. Vernickaite, O. Bersirova, H. Cesiulis, N. Tsyntsaru. Design of Highly Active Electrodes for Hydrogen Evolution Reaction Based on Mo-Rich Alloys Electrodeposited from Ammonium Acetate Bath**.** ***Coatings.*** **2019**, *9*(2), 85; https://doi.org/10.3390/coatings9020085 . 7. **H. Cesiulis,** N. Tsytsaru, E. J. Podlaha, D. Li, J. Sort. Electrodeposition of Iron-Group Alloys into Nanostructured Oxide Membranes: Synthetic Challenges and Properties*. Current Nanoscience*, 2019, 15, 84-99.

Certified during Doctoral Committee session on September 28th, 2021. Protocol No. 610000-KT-142.
Committee Chairman prof. habil. dr. Aivaras Kareiva