GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00058701		
Field of study	Materials Engineering, Materials Engineering		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Electrochemistry, Corrosion and Materials Engineering -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Artur Zieliński	
	Teachers	dr hab. inż. Artur Zieliński	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	30.0	0.0	0.0	45

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	1.0	4.0	50

Subject objectives

Understanding the different research techniques used in electrochemistry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_U04	Student performs experiment in the team.	[SU1] Assessment of task fulfilment
K7_W01	The student learns the story of electrochemical research.	[SW3] Assessment of knowledge contained in written work and projects
K7_W06	The student learns the principles of operation of devices used in electrochemistry.	[SW1] Assessment of factual knowledge

Subject contents	Construction of the electrochemical cell. The role of the individual electrodes. The working electrode (indicator). Materials used for the electrodes. Areas of potential work for different electrodes, the purity and the preparation of the working electrode.Measurements in equilibrium. Measurements in polarity. Other electrodes in electrochemical dish. Supporting electrolyte. The removal of oxygen. Calibration of the measuring cell. Measuring equipment.The operational amplifier in an open system. Feedback loop. Potentiostat based on a voltage follower. Compensation electrical resistance. Bipotencjostat. Galvanostat.Random walk theory and theoretical description of the motion of diffusion in microscale. The transition to a macroscopic scale and description of the flow of matter unchanging in time. Fick's first law. The stream of time-varying or description of places, under which the production or consumption of substances (reaction electrode). Fick's second law. Consequences describe the diffusion process using partial differential equations.Chronoamperometry. Equipment used in the measurement chronoamperometrycznych (potentiostatic). The theoretical assumptions of the experiment Cottrell (special case of measurement chronoamperometrycznego). Accounts using the Laplace transform. Cottrell equation and its applicability. Other cases chronoamperometrycznego experiment.Chronopotentiometry. Assumptions techniques. The realization of measurement. Advantages and disadvantages. Transition time, the equation Sanda, quantitative analysis. A curve for systems reversible and irreversible qualitative analysis. The impact of current niefaradajowskiego. Analysis of multicomponent systems. Chronopotencjoetria inversion.Chrnowoltamperometria. Introduction (utility analytical approach chronowoltamperometrycznego). Performing the experiment. Voltammetry on the electrodes flat reactions (reversible, irreversible and quasi-reversible). Multicomponent systems. Voltammetry electrodes static and hydrodynamic.Kinetics of electrode reactions. A dynamic equilibrium. Arrhenius concept. The theory of the active complex. Model Butler-Volmer. Factor passage. The standard rate constant. Current exchange. The dependence of the current-overpotential.Overvoltage activation and Concentration. Current limit. Butler-Volmer equation and its special cases. Stern's equation-Geary'eo. Tafel equation.
Prerequisites and co-requisites	electrochemistry

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
obecność, sprawozdania	100.0%	50.0%
zaliczenie pisemne	50.0%	50.0%

Recommended reading

Basic literature	Adolf Kisza, Elektrochemia 2. Elektrodyka, Wydawnictwa Naukowo-Techniczne, Warszawa, 2001. ISBN 83-204-2564-6.
Supplementary literature	Allen J. Bard, Larry R. Faulkner, Electrochemical methods: fundamentals and applications, John Wiley & Sons, New York, 2001. ISBN 04-710-4372-9. Praca zbiorowa, Encyclopedia of electrochemistry, WILEY-VCH, Weinheim, 2002. ISBN: 35-273-0250-5.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	When it is better to apply a standard rate constant and when the current exchange? 2. What is the experience Cottrell? 3. What is the primary electrolyte? 4. Discuss the shape of the typical CVA charts chronowoltamperometrycznych.
Work placement	Not applicable