



## Subject card

Subject name and code	, PG_00058701						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2022/2023		
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_W06		The student learns the principles of operation of devices used in electrochemistry.		[SW1] Assessment of factual knowledge		
	K7_W01		The student learns the story of electrochemical research.		[SW3] Assessment of knowledge contained in written work and projects		
	K7_U04		Student performs experiment in the team.		[SU1] Assessment of task fulfilment		

Subject contents	<p>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. Chronowoltamperometria. 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.</p>											
Prerequisites and co-requisites	electrochemistry											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="453 927 794 956">Subject passing criteria</th> <th data-bbox="799 927 1141 956">Passing threshold</th> <th data-bbox="1145 927 1482 956">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 963 794 992">zaliczenie pisemne</td> <td data-bbox="799 963 1141 992">50.0%</td> <td data-bbox="1145 963 1482 992">50.0%</td> </tr> <tr> <td data-bbox="453 999 794 1028">obecność, sprawozdania</td> <td data-bbox="799 999 1141 1028">100.0%</td> <td data-bbox="1145 999 1482 1028">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	zaliczenie pisemne	50.0%	50.0%	obecność, sprawozdania	100.0%	50.0%
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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											