



Subject card

Subject name and code	, PG_00065846						
Field of study	Materials Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2025/2026		
Education level	second-cycle studies	Subject group			Specialty 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	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			1.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Nanomaterials Physics -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marcin Łapiński				
	Teachers		dr hab. inż. Marcin Łapiński				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	15.0	0.0	0.0	15
	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	15	1.0		9.0		25
Subject objectives	The aim of the course is to familiarize students with the materials used in modern photovoltaic cells, the manufacturing methods of cell components, and the techniques for their analysis. Students will independently produce cell components and examine their properties.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W06] Knows the theoretical basics the functioning of scientific equipment in the fields of science and scientific disciplines relevant to materials engineering.	The student knows and can operate basic equipment used for the deposition of thin films for PV cells. They are able to plan and conduct an experiment.			[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
	[K7_U06] Can evaluate usefulness and feasibility of using new achievements (techniques and technologies) within the scope of materials science.	The student is able to plan and conduct an experiment, produce a functional component, and design and perform its analysis.			[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task		
Subject contents	The laboratory classes cover two topics. The first involves the fabrication of a transparent electrode used in PV cells and comparing the properties of the produced layer with commercially available materials. The second topic focuses on the independent fabrication of a semiconductor junction, which forms the main part of a photovoltaic cell, and measuring the properties of the obtained structure. Students will present the results of their work in a short written report.						
Prerequisites and co-requisites	Basic knowledge of the structure and operation of semiconductor junctions and photovoltaic cells.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		raport	51.0%
Recommended reading	Basic literature	Optical processes in semiconductors / Jacques I. Pankove Thin Films / edited by Alicia Esther Ares. Solar Energy / edited by Radu D. Rugescu.	
	Supplementary literature	Sol-gel processing and applications / edited by Yosry A. Attia. Handbook of physical vapor deposition (PVD) processing / Donald M. Mattox.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Development of ITO deposition technology using magnetron sputtering. Fabrication of CuO and ZnO layers using the sol-gel method.		
Work placement	Not applicable		

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