

Focused Ion Beam technique Educational subject description sheet

Basic information

Study programme Fizyka (Physics of Advanced Processing) Speciality - Organizational unit Faculty of Physics Study level Second-cycle programme Study form Full-time Education profile General academic	Materials for Energy	Didactic cycle 2023/24 Subject code 04FENS.28S.03281.23 Lecture languages English Course type Elective Block specialty subjects	
Subject coordinator	Karol Załęski		
Lecturer	Karol Załęski		
Period Semester 4	Activities and hours • Laboratories: 15, Graded cr	redit	Number of ECTS points

Goals

Code	Goal
C1	To become familiar with the principles of the Focused Ion Beam (FIB) technique used in micro and nanofabrication.
C2	To have experimental practice with the FIB technique: preparation of samples for Transmission Electron Microscopy imaging and milling of the periodic microstructures.

Subject learning outcomes

Code	Outcomes in terms of	Learning outcomes	Examination methods
Knowledge	e - Student:		
W1	will have essential experience in the operation and maintenance of Focused Ion Beam apparatus	FEN_K2_W01, FEN_K2_W02, FEN_K2_W04, FEN_K2_W07	Report
W2	will have practical experience in sample preparation for Transmission Electron Microscopy imaging on a Focused Ion Beam	FEN_K2_W01, FEN_K2_W02, FEN_K2_W04, FEN_K2_W07	Report
W3	will have practical experience in designing and fabricating periodic microstructures with the use of a Focused Ion Beam	FEN_K2_W01, FEN_K2_W02, FEN_K2_W04, FEN_K2_W07	Report
Skills - Student:			
U1	the essential operation of the Focused Ion Beam apparatus, e.g., sample mounting, beam calibration and adjustment, stage navigation	FEN_K2_U01, FEN_K2_U03, FEN_K2_U05	Report
U2	sample preparation for Transmission Electron Microscopy	FEN_K2_U01, FEN_K2_U03, FEN_K2_U05	Report
U3	designing and fabrication of periodic microstructures on Si substrates with the use of a Focused Ion Beam and Xenos Exposure Control Program	FEN_K2_U01, FEN_K2_U03, FEN_K2_U05	Report

Study content

No.	Course content	Subject learning outcomes	Activities
1.	Introduction to the Focused Ion Beam technique.	W1, U1	Laboratories
2.	Sample preparation for a Transmission Electron Microscopy.	W2, U2	Laboratories
3.	Designing and fabrication of periodic microstructures.	W3, U3	Laboratories

Additional information

Activities	Teaching and learning methods and activities
Laboratories	Lecture with a multimedia presentation of selected issues, Laboratory method

Activities	Credit conditions
Laboratories	Active attendance in the laboratory and final preparation of the report.

Literature

Obligatory

1. Focused ion beam systems: basics and applications / ed. by Nan Yao., Cambridge University Press, 2010

Optional

1. Xenos ECP Instruction Manual

Calculation of ECTS points

Activities	Activity hours*
Laboratories	15
Preparation for classes	20
Report preparation	15
Student workload	Hours 50
Number of ECTS points	ECTS 2

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

Kod	Treść
FEN_K2_U01	The graduate can use their knowledge to formulate and solve complex and unusual problems in the field of physical sciences; select and apply appropriate methods and tools necessary to solve a given problem (including advanced IT techniques), as well as adapt existing methods and tools or develop completely new ones
FEN_K2_U03	The graduate can formulate and test hypotheses related to simple research problems in physics (plan and perform observations, experiments, theoretical calculations or computer simulations and critically evaluate and discuss the results obtained)
FEN_K2_U05	The graduate can use English in accordance with the requirements set out for level B2+ of the Common European Framework of Reference for Languages, as well as specialist English terminology in the field of physical sciences
FEN_K2_W01	The graduate knows and understands in-depth selected facts, phenomena, concepts and theories specific to physics and complex relationships between them (constituting advanced general knowledge in the field of physical sciences and representing both key and other selected issues in the field of advanced detailed knowledge in this discipline)
FEN_K2_W02	The graduate knows and understands in-depth selected research methods and tools as well as mathematical models used in physics
FEN_K2_W04	The graduate knows and understands main development trends in the discipline of physical sciences
FEN_K2_W07	The graduate knows and understands workplace health and safety principles to the extent that allows independent work in the research workplace