COURSE DESCRIPTION CARD - SYLLABUS

Course name
Materials with special physical properties [S2IMat1>MoSWF]

Course

Field of study
Materials Engineering

Year/Semester
1/2

Area of study (specialization)
Nanomaterials

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr hab. inż. Andrzej Miklaszewski prof. PP
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Lecturers

Prerequisites

Basic knowledge of physics, chemistry, materials technology. Skills: logical thinking, using information from the library and the Internet. Understanding the need to learn and acquire new knowledge.

Course objective

1.Provide students with basic knowledge of materials/nanomaterials with physical characteristics, to the extent specified by the curriculum content specific to the field of study. 2.Develop students" ability to solve simple problems related to the selection of materials/nanomaterials with physical characteristics, distinguish materials and analyse the results of microscopic observations based on the acquired knowledge. 3.Shaping teamwork skills in students.

Course-related learning outcomes

Knowledge:
1. the student shall characterise materials/nanomaterials with special physical characteristics. [k_w04.k_w10]
2. the student should characterize the basic processes of obtaining materials/nanomaterials with special physical properties - [k_w08,k_w12,k_w14,k_w15]

Skills:
1. the student can select materials/nanomaterials with physical properties depending on the applications - [k_u01,k_u03,k_u5,k_u13,k_u14]
2. the student can propose the use of materials/nanomaterials with physical properties - [k_u01,k_u05]
3. the student is able to carry out research of materials/nanomaterials with physical properties - [k_u04,k_u05,k_u08,k_u09]

Social competences:
1. student can collaborate in a group - [k_k03]
2. the student is aware of the role of materials/nanomaterials with special physical properties in the modern economy and for society - [k_k02]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: Pass on the basis of a colloquium consisting of 5 general questions (pass in case of correct answer to min. 3 questions: <3 ? ndst, 3 ? dst, 3.5 ? dst+, 4 ? db, 4.5 ? db +, 5 ? bdb) carried out at the end of the semester.
Laboratory: Based on an oral or written response to the content of each laboratory exercise performed, a report of each laboratory exercise according to the indications of the laboratory exercise operator. In order to be counted in laboratories, all exercises must be completed (positive assessment from the response and report).

Programme content

Lecture:
Technologies for manufacturing materials with special physical properties
Structural studies of materials with special properties
Magnetic and electrical properties of materials
Soft and hard magnetic materials with nanostructures
Metallic glasses and amorphous systems
Ferroic and multiferroic materials with nanostructure
Secondary hydrogen-absorbing systems based on metal hydrides with nanostructures
Laboratory:
1.FERROELECTRICS, MULTIFERROICS WITH NANOSTRUCTURE - SYNTHESIS OF BISMUTH FERRATE
2.FERROELECTRICS, MULTIFERROICS WITH NANOSTRUCTURE - EFFECT OF CHEMICAL COMPOSITION ON THE PROPERTIES OF THE BFO PHASE
3.MAGNETICALLY SMART COMPOSITE MATERIALS - study of the effect of chemical composition and fabrication parameters on properties
4 MAGNETICALLY HARD COMPOSITE MATERIALS - a study of the effects of chemical composition and manufacturing parameters on properties
5 METALLIC GLASSES 6. REFRESHIBLE hydrogen ABSORBING MATERIALS - study of hydrogen desorption sorption kinetics

Course topics

Lecture:
Technologies for manufacturing materials with special physical properties. Structural studies of materials with special properties
Magnetic and electrical properties of materials.
Soft and hard magnetic materials with nanostructures. Metallic glasses and amorphous systems. Ferroic and multiferroic materials with nanostructure.
Secondary hydrogen absorbing systems based on metal hydrides with nanostructure.
Laboratory:
FERROELECTRICS, MULTIFERROICS WITH NANOSTRUCTURE - SYNTHESIS OF BISMUTH FERRATE, EFFECT OF CHEMICAL COMPOSITION ON BFO PHASE PROPERTIES. MAGNETICALLY

SMART COMPOSITE MATERIALS - study of the effect of chemical composition and fabrication parameters on properties. MAGNETICALLY HARD COMPOSITE MATERIALS - a study of the effect of chemical composition and fabrication parameters on properties.
METALLIC GLASSES. REFLECTIVE hydrogen ABSORBING MATERIALS - study of hydrogen desorption sorption kinetics.

Teaching methods

1. Lecture: multimedia presentation, presentation illustrated by examples given on the board,
2. Laboratory exercises: practical exercises, discussion, teamwork, case study.

Bibliography

Basic
1. C. Kittel, Wstęp do fizyki ciała stałego, Państwowe Wyd. Naukowe Warszawa
2. M. Jurczyk, Nanomateriały. Wybrane zagadnienia, Wyd. Pol. Pozn.
3. R. Pampuch, Współczesne materiały ceramiczne, Uczelniane Wyd. Naukowo-Dydaktyczne AGH, Kraków 2005
4. M. Jurczyk, J. Jakubowicz, Nanomateriały ceramiczne. Wyd. Pol. Pozn. 2004
5. M. Jurczyk, Mechaniczna synteza, Wyd. Pol. Pozn. 2003
6. D. Senczyk, Rentgenografia strukturalna, WPP, Poznań 1988
7. M. Cytro, D. Pavuna, Wstęp do nadprzewodnictwa, Państwowe Wyd. Naukowe Warszawa 1996
8. J. Stankowski, B. Czyżak, Nadprzewodnictwo, WNT, Warszawa 1999
9. W. Przygocki, A. Włochowicz, Fulereny i nanorurki, WNT Warszawa 2001
Additional
1. Krajowe I zagraniczne czasopisma naukowe - J. Alloys Compounds, Mater. Sc.Eng

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	35	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	1,00