



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Functional materials [S1IMat2>MF]

Course

Field of study

Materials Engineering

Year/Semester

3/5

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-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

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Lecturers

Prerequisites

Basic knowledge of physics, chemistry, materials science. The student has the ability to think logically, use information obtained from the library and the Internet. Understanding the need to learn and constantly acquire new knowledge in relation to ongoing research in materials engineering.

Course objective

1. The basic knowledge about functional materials. 2. Developing students' skills in solving simple problems related to the selection of functional materials for specific devices.

Course-related learning outcomes

Knowledge:

1. The student has knowledge about functional materials.
2. The student has knowledge about applications of the special physical properties materials.
3. The student has knowledge about technology related to the special properties materials.

Skills:

1. The student is able to obtain information from scientific literature about new functional materials.

2. The student can perform the basic investigation of functional materials.
3. The student can propose applications of functional materials.

Social competences:

1. The student can collaborate in order to obtain and implement the new knowledge.
2. The student is aware of importance of functional materials in modern industry and society.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: The good knowledge about the topics presented during the lectures (verified in the final colloquium) and/or acquiring and presenting new knowledge on modern aspects of functional materials.

Assessment criteria/assessment: in accordance with the study regulations.

Tutorials: The attendance to all classes, performing all tasks and a positive assessment of the oral/written answers and/or the partial and/or final tests. Assessment criteria/assessment: in accordance with the study regulations.

Programme content

Basic knowledge about functional materials - their properties, manufacturing methods, the influence of structure on properties and applications

Course topics

Lectures:

1. Different groups of materials related to electrical conductivity.
2. Dielectrics and dielectric relaxations.
3. High-k materials.
4. Piezoelectric and pyroelectric materials.
5. Ferroelectric materials.
6. Diamagnetic, paramagnetic, ferromagnetic, antiferromagnetic and ferrimagnetic materials.
7. Applications of functional materials.

Laboratory:

1. Preparation of functional materials.
2. Mechanochemical synthesis.
3. Structural investigations of special materials.
4. Magnetic properties of materials.

Teaching methods

Lecture: multimedia presentation, analysis of devices (case study),

Tutorials: practical exercises using IIM research infrastructure (e.g. high-energy mills, X-ray diffractometer, metallographic microscopes, available didactic sets intended for the above-mentioned topics of exercises), discussion and development of results, formulation of conclusions regarding the issues discussed during classes scientific papers, usage of high energy ball mills, X-ray diffractometry, problem solving, discussions, elements of activated methods (brainstorming, discussion, group work) and the flipped classroom.

Bibliography

Basic:

1. Waser R. (red.), Nanoelectronics and Information Technology. Wiley, Weinheim 2003
2. Nogas-Ćwikiel E., Otrzymywanie proszków ceramicznych do kompozytów ceramiczno-polimerowych dla detektorów piroelektrycznych. Katowice 2012
3. Surowiak Z. (red.), Elektroceramika ferroelektryczna, Wydawnictwo UŚ, Katowice 2004
4. Graja A., Ferchmin A.R. (red.), Przemiany fazowe. Małe Monografie IFM, Tom II, Poznań 2003
5. Encyklopedia Fizyki Współczesnej, PWN, Warszawa 1983
6. Krajewski T. (red.), Zagadnienia fizyki dielektryków. Wydawnictwa Komunikacji i Łączności, Warszawa 1970
7. Blicharski B., Wstęp do inżynierii materiałowej. WNT, Warszawa 2012
8. Przesławski J., Multiferroiki i nanoferroelektryki.

<http://www.wfa.uni.wroc.pl/pub/content/2280/files/Multiferroiki%20i%20ultraferroiki%20-%20Przes%C5%82awski.pdf>

9. Pikul M., Fizyka Magnetyków.

<http://www.wfa.uni.wroc.pl/pub/content/2280/files/Fizyka%20magnetyk%C3%B3w%20-%20Pikul.pdf>

10. Jurczyk M., Nanomateriały. Wybrane zagadnienia. Wydawnictwo Politechniki Poznańskiej, 2001

11. Jurczyk M., Jakubowicz J., Nanomateriały ceramiczne. Wydawnictwo Politechniki Poznańskiej, 2004

12. Jurczyk M., Mechaniczna synteza, Wydawnictwo Politechniki Poznańskiej, 2003

Additional:

1. Scientific papers

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00