COURSE DESCRIPTION CARD - SYLLABUS

Course name
Functional materials in vehicles [S1MiTPM1>MFwP]

Course

Field of study
Materials and technologies for automotive industry

Year/Semester
2/4

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

Basic knowledge about functional materials and their use in vehicles. 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 should know the basic groups of functional materials used in the automotive industry and link them to the crystal structure and technological process.
2. The student should know the basic processes of obtaining functional materials.

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

used in the automotive industry.
2. The student is able to plan and perform basic tests of functional materials and interpret the results and draw conclusions.

Social competences:
1. The student is aware of the importance and understanding of the effects of producing functional materials and their impact on the environment.
2. The student understands the need to acquire new knowledge in connection with the research work carried out in the field of functional materials.

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.
Laboratory:
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.

Programme content

Basic knowledge about functional materials - their properties, manufacturing methods, the influence of structure on properties and applications (primarily in vehicles)

Course topics

Lecture:
1. Different groups of materials related to electrical conductivity (metals, semiconductors, insulators, superconductors).
2. Dielectrics and dielectric relaxation.
3. Materials with high dielectric permittivity.
4. Piezoelectric and pyroelectric materials.
5. Ferroelectric materials.
6. Diamagnets and paramagnets, ferromagnets, antiferromagnets, ferrimagnets.
7. Vehicle parts and devices based on functional materials
Laboratory:
1. Methods of obtaining functional materials.
2. Influence of mechanical synthesis process parameters on final properties of materials.
3. Structural analysis of functional materials.
4. Materials with magnetic properties - determination of magnetic domain widths.
5. Analysis of finished elements containing functional materials

Teaching methods

Lecture: multimedia presentation, analysis of finished elements, case study, discussion
Laboratory: 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.

Bibliography

Basic:
„Nanoelectronics and Information Technology”, R. Waser (red.), Wiley, Weinheim 2003
E. Nogas-Ćwikiel „Otrzymywanie proszków ceramicznych do kompozytów ceramiczno-polimerowych dla detektorów piroelektrycznych”, Katowice 2012
„Elektroceramika ferroelektryczna”, Z. Surowiak (red.) Wydawnictwo UŚ, Katowice 2004
„Przemiany fazowe” A. Graja, A.R. Ferchmin (red.), Małe Monografie IFM, Tom II (Poznań 2003)
Encyklopedia Fizyki Współczesnej, PWN, Warszawa 1983
„Zagadnienia fizyki dielektryków” T. Krajewski (red.), Wydawnictwa Komunikacji i Łączności (Warszawa

1970)
M. Blicharski, „Wstęp do inżynierii materiałowej”
M. Jurczyk „Mechaniczna synteza”, Wydawnictwo Politechniki Poznańskiej, 2003

Additional:
Scientific papers (e.g.. Physics Today)
J. Przesławski „Multiferroiki i nanoferroelektryki”
http://www.wfa.uni.wroc.pl/pub/content/2280/files/Multiferroiki%20i%20ultraferroiki%20-%20Przes%C5%82awski.pdf
M. Pikul, „Fizyka Magnetyków”
http://www.wfa.uni.wroc.pl/pub/content/2280/files/Fizyka%20magnetyk%C3%B3w%20-%20Pikul.pdf
M. Jurczyk, Nanomateriały. „Wybrane zagadnienia”, Wydawnictwo Politechniki Poznańskiej, 2001
M. Jurczyk, J. Jakubowicz, „Nanomateriały ceramiczne”, Wydawnictwo Politechniki Poznańskiej, 2004

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