COURSE DESCRIPTION CARD - SYLLABUS

Course name
Metal-ceramic nanomaterials [S2IMat1-Nanomat>NM-C]

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
andrzej.miklaszewski@put.poznan.pl

Lecturers

Prerequisites

Knowledge: basic knowledge of physics, chemistry, materials science, Skills: logical thinking, using information obtained from the library and the Internet Social competences: understanding the need to learn and acquire new knowledge

Course objective

1. Provide students with basic knowledge of the technology of obtaining metal and ceramic nanomaterials, to the extent specified by the program content appropriate for the field of study 2. Developing students" skills to solve simple problems related to the application of metal-ceramic nanomaterials. 3. Shaping students" teamwork skills

Course-related learning outcomes

Knowledge:
1. the student should be able to characterize metal-ceramic nanomaterials - [k_w04, k_w10]
2. the student should characterize the basic processes of obtaining metal-ceramic nanomaterials - [k_w06, k_w08,]

Skills:
1. the student is able to select metal-ceramic nanomaterials depending on the application - [k_u11]
2. the student is able to propose the use of metal-ceramic nanomaterials - [k_u07, k_u05]
3. the student is able to conduct research on metal-ceramic nanomaterials - [k_u05, k_u08, k_u09]

Social competences:
1. student potrafi współpracować w grupie - [k_k03]
2. student jest świadomy roli materiałów/nanomateriałów o specjalnych właściwościach fizycznych we współczesnej gospodarce i dla społeczeństwa - [k_k07]

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 based on a test consisting of 5 general questions (pass if the correct answer to at least 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: Assessment based on an oral or written answer concerning the content of each performed laboratory exercise, a report on each laboratory exercise according to the instructions of the laboratory teacher. To pass the laboratories, all exercises must be passed (positive grade from the answers and the report).

Programme content

Lecture:
Nanomaterials and microcrystalline materials. Synthesis of metal-ceramic nanomaterials. Technologies: vapor deposition, non-equilibrium processes, thin layer technique, sol-gel method, chemical reactions in the gas phase. Methods of consolidation of powder materials. Preparation of thin layers. Metal-ceramic nanocomposites: titanium-bioceramics, titanium? TiB, nickel-free stainless steel-hydroxyapatite. Metal-cetramic bionanocomposites.
Lab:
1) Methods of obtaining nanomaterials on the example of the mechanical synthesis process
2) Methods for analyzing selected properties of nanomaterials
3) Titanium-bioceramics nanocomposites,
4) Titanium nanocomposites? TiB,
5) Nickel-free stainless steel-hydroxyapatite type nanocomposites.
6) Metal-cetramic bionanocomposites.

Course topics

Lecture:
Nanomaterials vs. microcrystalline materials. Synthesis of metal-ceramic nanomaterials.
Technologies: gas phase deposition, non-equilibrium processes thin film technique, sol-gel method, chemical reactions in the gas phase. Methods of consolidation of powder materials. Obtaining thin films.
Metal-ceramic nanocomposites: titanium-bioceramics, titanium ? TiB, nickel-free stainless steel-hydroxyapatite. Bionanocomposites of metal-ceramics.
Laboratory:
Methods of obtaining nanomaterials on the example of the mechanical synthesis process. Methods of analysis of selected properties of nanomaterials. Nanocomposites of titanium-bioceramics type. Nanocomposites of the titanium-TiB type. Nanocomposites of nickel-free stainless steel-hydroxyapatite type.
Metal-ceramic bionanocomposites.

Teaching methods

1. Lecture: multimedia presentation, presentation illustrated with examples given on the blackboard. Laboratory exercises: practical exercises, discussion, and preparation of the results in the form of a report, formulation of conclusions regarding the issues discussed during classes.

Bibliography

Basic

1. Nanomateriały inżynierskie konstrukcyjne i funkcjonalne. Red. K. Kurzydłowski, M. Lewandowska. PWN
2. A. Sokołowska, A. Michalski, K. Zdunek, A. Olszyna, Niekonwencjonalne środki syntezy materiałów, PWN, Warszawa 1991.
3. M. Jurczyk, J. Jakubowicz, Nanomateriały ceramiczne. Wyd. Pol. Pozn. 2004
4. M. Jurczyk, Mechaniczna synteza, Wyd. Pol. Pozn. 2003
5. M. Jurczyk, J. Jakubowicz, Bionanomateriały, Wyd. Pol. Pozn. 2008
Additional

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	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