COURSE DESCRIPTION CARD - SYLLABUS

Course name

Modelling of the structure and properties of diffusion layers

Course

Field of study

Materials Engineering

Area of study (specialization)

Metal and plastic materials

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

polish

Requirements

elective

Year/Semester

2/3

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	
Tutorials	Projects/seminars	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Faculty of Materials Engineering and Technical Physics

Piotrowo 3 Street, 60-965 Poznań

Responsible for the course/lecturer:

Responsible for the course/lecturer:

Prerequisites

Knowledge: basic knowledge of materials engineering and surface treatment.

Skills: logical thinking, use of the information obtained from the library and the Internet, operation of the basic computer software.
Social competencies: understanding the need for learning and acquiring new knowledge.

Course objective

Acquainting with theoretical and practical problems of planning the thermochemical treatment in order to provide required functional properties for the surface layer.

Course-related learning outcomes

Knowledge

1. Student has an underpinned theoretically and detailed knowledge of selected issues from the materials engineering, and can describe the surface phenomena and thermochemical treatment. [T2A_W04] [K2_W06]
2. Student knows the basic methods, techniques, tools and materials used in solving complex engineering tasks in materials engineering, thanks to which he can describe the thermodynamic, kinetic and structural aspects of technological processes of manufacturing and processing of engineering materials. [T2A_W07] [K2_W11]
3. Student has the knowledge necessary to understand social, economic, legal and other non-technical determinants of engineering activity. He has the knowledge to describe and apply material technologies in the economic and ecological aspects, social communication in the organization, organizational culture, computer-aided production management, services and personnel. [T2A_W08] [K2_W12]

Skills

1. Student is able to determine the directions of further learning and implement the process of self-education. [T2A_U05] [K2_U05]
2. Student is able to plan and carry out experiments, including measurements and computer simulations, interpret the results obtained and draw conclusions. [T2A_U08] [K2_U08]
3. Student is able to use the simulation and experimental analytical methods for formulating both solving engineering problems and simple research problems. [T2A_U09] [K2_U09]
4. Student is able - when formulating and solving engineering tasks - to integrate knowledge from material engineering and apply a system approach that also takes into account non-technical aspects. He is able to shape the structure and properties of engineering materials by selecting the right technological process. [T2A_U10] [K2_U11]
5. Student is able to assess the usefulness and possibility of using new achievements (techniques and technologies) in materials engineering. He is able to design engineering materials and technological processes, produce materials with the required physicochemical and functional properties. [T2A_U12] [K2_U13]
6. tudent has the preparation necessary to work in an industrial environment and knows the safety rules related to this work. He has the ability to manage personnel and production process and services using computer-aided tools. [T2A_U13] [K2_U14]

7. Student is able to make a critical analysis of the way of functioning and evaluate - especially in connection with the field of materials engineering - existing technical solutions, in particular devices, technological processes, materials. [T2A_U15] [K2_U16]
8. Student is able to assess the usability of the methods and tools being used to solve the task engineering, characteristic of the materials engineering. [T2A_U18] [K2_U19]

Social competences
1. Student is aware of importance and understanding the differents aspects and effects of engineering activity, including its impact on the environment and the associated responsibility for decisions. [T2A_K02] [K2_K02]
2. Student is able to interact and work in a group, taking on different roles in it. [T2A_K03] [K2_K03]
3. Student is able to think and act in a creative and entrepreneurial way. [T2A_K06] [K2_K06]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:
Lecture: Ranking based on written examination consisting of general and test questions (ranking in case of getting at least 51% of points: <51% 2 - ndst, 51%-62% 3 - dst, 63%-72% 3,5 - dst+, 73%-83% 4 - db, 84%-94% 4,5 - db+, > 94% 5 - bdb) written for the end of the semester.
Laboratory: Ranking based on an oral answer from the scope of contents of the performed laboratory excersise and report on every laboratory exercise according to indications of the leading the laboratory exercises.The average score of all the laboratory exercises is calculated. All the exercises have to be accepted in respect of oral answer and report.

Programme content

Lecture:
1. Essence of applying diffusion layers in the materials engineering.
2. Classification of methods of producing diffusion layers.
3. Basic technological processes of formation of diffusion layers: carburizing, nitriding, boriding, carbide layers.
4. Heat treatment of diffusion layers: volume and laser.
5. Devices for producing diffusion layers.
6. Microstructures of diffusion layers.
7. Basic functional properties of diffusion layers: hardness, wear resistance, fatigue strength, cohesion, fracture toughness, corrosion resistance.
8. Modelling of the structure and functional properties of diffusion layers.
Laboratory:
1. Microstructure of diffusion layers produced with various methods
2. Microhardness of diffusion layers produced with various methods
3. Fracture toughness of diffusion layers produced with various methods
4. Cohesion of diffusion layers produced with various methods

5. Wear resistance tests of diffusion layers produced with various methods

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.
2. Laboratory: practical exercises, performing experiments, discussing, working in a team.

Bibliography

Basic
1. Praca zb. pod. red. Burakowskiego T., Obróbka cieplna metali, SIMP-IMP,W-wa 1987, tom 1÷7.
2. Kula P., Inżynieria warstwy wierzchniej, Wyd. Politechniki Łódzkiej, 2000.
3. Burakowski T., Wierzchoń T., Inżynieria powierzchni metali, WNT, Warszawa, 1995

Additional
1. Pertek A., Kształtowanie struktury i właściwości warstw borków żelaza otrzymywanych w procesie borowania gazowego, Wyd. PP 2001.
2. Młynarczak A., Modyfikowanie budowy i właściwości jedno- i wieloskładnikowych dyfuzyjnych warstw węglików chromu, wanadu i tytanu wytwarzanych na stalach metodą proszkową, Wyd. PP, 2005.
3. Małdziński L., Termodynamiczne, kinetyczne i technologiczne aspekty wytwarzania warstwy azotowanej na żelazie i stalach w procesach azotowania gazowego, Wyd. PP, 2002.
4. Kulka M., The gradient boride layers formed by borocarburizing and laser surface modification, Wyd. PP, 2009.

Breakdown of average student's workload

	Hours	ECTS
Total workload	66	2
Classes requiring direct contact with the teacher	30	1
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	36	1

[1] delete or add other activities as appropriate