COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modern technology of heat treatment and thermo-chemical treatment [S2IMat1>NTOCiCC]

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 (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The basic knowledge of physics, chemistry, heat treatment, welding and materials science.

Course objective

It familiarizes itself with novelties in the range of the heat treatment technology, and also possibilities as well as the elements of control in the heat treatment processes. The skills: the logical thinking, use of the information obtained from the library and the Internet. The understanding needs for learning and acquiring new knowledge

Course-related learning outcomes

Knowledge:
1. the student should characterize the development directions of the heat treatment technology. [k_w01,k_w04]
2. the student should indicate the new materials available for use in the revision of the heat treatment processes. - [k_w05,k_w06]
3. the student should propose new energy sources, which it is possible to use heat treatment technology. - [k_w09,k_w11,k_w12]

Skills:
1. the student is able to propose new heat treatment process to the material in order to obtain the relevant mechanical properties. - [k_u01,k_u02]
2. the student is able to deploy new materials in order to modernize and upgrade heat treatment processes. - [k_u07,k_u10,k_u13]
3. the student should be able to take advantage of new heating technique in heat treatment processes. [k_u14,k_u15,k_u16]

Social competences:
1. the student is able to work in a group - [k_k03]
2. the student is aware of the role of modernization and revision of the heat treatment processes in the modern economy and to the development of society. - [k_k02,k_k06,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
The credit of lecture on the basis of a written answer consisting of 2 (two) - 6 (six) questions or test on Moodel PP platform, which realized at the end of the semester.
Evaluation criteria: dst => 50.1 to 70%; db => 70.1 ÷ 90%; bdb => 90.1 ÷ 100%
Laboratory
The credit of laboratory on the basis of the answer oral or written from the scope of the content of each performed laboratory exercise (3 to 5 questions) or test realized on Moodel PP platform.
Evaluation criteria: dst => 50.1 to 70%; db => 70.1 ÷ 90%; bdb => 90.1 ÷ 100%
It gets the credit of laboratories all exercises have to be included (positive opinion from the answer and included reports).

Programme content

Lecture
1) The developmental tendencies of the technology in the heat treatment and thermo- chemical treatment processing.
2) The technologies of the heat treatment the using new ways of warming.
3) Technologies leanings on CVD and PVD methods.
4) The cooling - the new quenching mediums, new method.
5) The induction hardening - new possibilities.
6) New tendencies in the sub-zero treatment process.
Laboratory
1) The notion of modernity in heat treatment from regard on the economical ness of the process.
2) The quenching mediums friendly for the natural environment - the cooling curve.
3) The influence of nanoparticle kind of solid bodies in quenching mediums on the cooling parameters.
4) The influence of warming the surface on the obtained properties of top layer - laser, plasma, flame technique.
5) The composite or hybrid processes in creating the propriety of top layer.

Teaching methods

1. Lecture: multimedia presentation or meeting on platform of e-Meeting PP
2. Laboratory exercises: performing exercises, discussion, team work.

Bibliography

Basic
1. Totten G.E., Bates C.E., Clinton N.A.: Handbook of Quenchants and Quenching Technology; ASM International; Materials Park, OH 44073-0002; May 1995
2. Leda H.: Współczesne materiały konstrukcyjne i narzędziowe; Wyd. P.P. 1998,wyd. 2, stron 296
3. Totten G. E., Pye D., Przyłęcka M., Gęstwa W. : Chapter 29 - Heat Treating of Steel; w książce pt: Smithells Metals Reference Book; Edited By: William F. Gale, Terry C. Totemeier; Editorial Services Unit,

Elsevier Science Ltd, The Boulevard Langford Lane Kidlington, Oxford; 2004, s.29-1 ÷ 29-83
4. Przyłęcka M., Gęstwa W., Funatani K., Totten G. E.: Part III The heat Treatment; Chapter13 - Design of Carburizing and Carbonitriding Processes in the book: Handbook Of Metallurgical Design; Edited By: G.E. Totten, K. Funatani and L. Xie; In Production Marcel Dekker Inc., 270 Madison New York,2004, NY 10018, s. 507 ÷ 543
Additional
1. Luty W.: Chłodziwa hartownicze, Wyd. Naukowo-Techniczne, Warszawa 1986;
2. Przyłęcka M., Gęstwa W., Canal L. C. F., Xin Yao, Totten G. E.: Chapter - Source of Failures in Carburized and carbonitrided Components in the book: Failure Analysis of Heat Treated Steel Components; Edited By: G.E. Totten, L.E. Canal and Y. Xin; Pierwsze wydanie, 2008, ASM International, Materials Park, Ohio, s.177 - 240
3. Praca zbiorowa pod. red. Burakowskiego T.: Obróbka cieplna metali., SIMP-IMP, Warszawa 1987, tom 1÷7
4. Liąčić B., Tensi H.M., Luty W.: Theory and Technology of Quenching; Springer-Verlag Berlin Heideberg New York; 1992
5. The current articles connected with the subject matter of the topic.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	40	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	1,00