



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Metallurgy of welding processes [S2IMat1>MPS]

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

0

Other

0

Tutorials

15

Projects/seminars

0

Number of credit points

2,00

Coordinators

dr inż. Artur Wypych

artur.wypych@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of metallurgy, physics, chemistry and materials science. Skills: logical thinking, using information obtained from the library and the Internet. Understanding the need to learn and acquire new knowledge.

Course objective

Acquainting with the physical and chemical phenomena accompanying the welding processes and the metallurgy of these processes.

Course-related learning outcomes

Knowledge:

1. the student should characterize the basic metallurgical processes occurring during welding. - [k_w04, k_w07, k_w08]
2. the student should select the parameters of the welding process to the type of materials to be welded and the intended final effect. - [k_w07, k_w10]
3. the student should define the basic processes in the field of metallurgy, crystallization, cracking and phase and microstructural changes of welds. - [k_w10, k_w12]

Skills:

1. the student is able to use the research equipment for the evaluation of the quality of bonded joints. - [k_u01, k_u05, k_u12]
2. the student is able to choose the initial conditions of the bonding processes due to the materials used and the intended final effect. - [k_u011, k_u12]
3. the student is able to plan the course of the bonding process and shape the basic properties of the joints. - [k_u011, k_u12]

Social competences:

1. the student is able to work in a group - [k_k01, k_k03, k_k04]
2. the student is aware of the role of bonding processes in the modern economy and for society. - [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: pass on the basis of 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.

Classes: Assessment based on an oral or written answer regarding the content of each exercise, report on each exercise according to the instructions of the laboratory teacher. In order to pass the laboratories, all exercises must be passed (positive grade from the answers and the report).

Programme content

Lectures:

1. Presentation of factors influencing the change of bonding processes.
2. Determination of the influence of particular factors on the course of bonding processes.
3. Demonstration of changes in the operational properties of bonded joints as a function of changing parameters of the bonding process.
4. Discussion of issues in the field of: formation of the weld pool, gas-metal reactions, bubble formation, the role of slag in welding processes, the share of welding consumables, the role of shielding gases in the welding process of various metals, crystallization of pure metals and alloys, crystallization mechanism, nucleation, structural changes in the crystallization processes of metals and alloys, cold and hot cracking, structural and phase changes in steels during welding.

Exercises:

1. Presentation of lecture problems with the use of mathematical apparatus.
2. Modeling the course of selected welding processes.
3. Determining the thermal field and the share of the base material in the joint.

Course topics

The essence of the issues discussed in the course Metallurgy of Welding Processes, is to define and clearly explain the conditions affecting the metallurgy of welding processes from the point of view the rate of heat input, the volume of the remelted zone, the effect of mixing materials in the welding pool, the rate of solidification, the rate of cooling and the extent of microstructural transformations occurring in the base material and the welded node. At the same time, the course includes an explanation of the processes occurring between materials in the joining zone during thermal spraying processes, which are the opposite of classical welding processes such as padwelding by various methods. In addition, the course defines the application of different types of heat sources to welding processes due to the energy density and the rate of heat introduction into the materials in the zone of direct interaction of these sources.

Teaching methods

1. Lecture: presentation illustrated with examples given on the blackboard, solving problems.
2. Exercises: problem solving, modeling, discussion.

Bibliography

Basic

1. Metalurgia Spawania, Edmund Tasak, JAK Kraków, 2008

2. Spawalnictwo, Ferenc K., WNT, Warszawa, 2007

Additional

1. Poradnik Inżyniera Spawalnictwo cz.1, Pilarczyk J., WNT, Warszawa, 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	34	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	21	1,00