Module name: Dobór technik wytwarzania i kształtowania materiałów dla podstawowych grup materiałowych

Academic year: 2019/2020  Code:  ZSDA-3-0176-s  ECTS credits:  2

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH  Specialty: —

Study level: Third-cycle studies  Form and type of study: Full-time studies

Lecture language: Polski i Angielski  Profile of education: Academic (A)  Semester: 0

Course homepage: —

Responsible teacher: prof. dr hab. inż. Jaworska Lucyna (ljaw@agh.edu.pl)

Module summary
Students will learn about the principles of selection of manufacturing techniques for the shaping of products for four basic groups of materials, depending on their properties. The basic features of the microstructure of materials obtained by such techniques as: metal forming, casting, sintering, machining and additive methods will be discussed. PhD students will become familiar with material shortcomings resulting from the use these techniques as well as with methods that limit these drawbacks.

Description of learning outcomes for module

<table>
<thead>
<tr>
<th>MLO code</th>
<th>Student after module completion has the knowledge/ knows how to/is able to</th>
<th>Connections with FLO</th>
<th>Method of learning outcomes verification (form of completion)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Social competence: is able to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_K001</td>
<td>Critical assessment of the achievements in the field of manufacturing techniques and their impact on the properties of shaped materials, critical assessment of their own contribution to the development of material engineering, recognition of the importance of knowledge in solving cognitive problems in the field of product and practical process development;</td>
<td>SDA3A_K01</td>
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</tbody>
</table>

Skills: he can
To use knowledge in the field of materials engineering and mechanical engineering to creatively identify, formulate and innovative solving of complex problems in the selection of techniques for shaping different materials, in particular: define the goal and subject of scientific research, formulate a research hypothesis; develop methods, techniques and research tools and apply them creatively; conclude on the basis of the results of scientific research; perform critical analysis and evaluation of the results of scientific research, expert activities and other creative work as well as their contribution to the development of knowledge; transfer the results of scientific activity to the economic and social sphere;

Knowledge: he knows and understands

To the extent enabling revision of existing paradigms, global achievements in the field of production techniques and materials science, covering theoretical foundations and general issues and selected specific issues relevant to material engineering or scientific disciplines within which they are preparing a doctoral dissertation in the appropriate selection of material shaping techniques;

Fundamental dilemmas of modern civilization in the field of producing new "non-technological" materials;

Economic, legal, ethical and other important conditions for scientific activity in the field of shaping new material groups

Number of hours for each form of classes

<table>
<thead>
<tr>
<th>Suma</th>
<th>Lectures</th>
<th>Auditorium classes</th>
<th>Laboratory classes</th>
<th>Project classes</th>
<th>Conversation seminar</th>
<th>Seminar classes</th>
<th>Practical classes</th>
<th>Fieldwork classes</th>
<th>Workshops</th>
<th>Prace kontrolne i przejściowe</th>
<th>Lektorat</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>15</td>
<td>0</td>
<td>0</td>
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</table>

FLO matrix in relation to forms of classes

<table>
<thead>
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<td>Prace kontrolne i przejściowe</td>
</tr>
</tbody>
</table>
|          |                                                                          | Lektorat

Social competence: is able to
Critical assessment of the achievements in the field of manufacturing techniques and their impact on the properties of shaped materials, critical assessment of their own contribution to the development of material engineering, recognition of the importance of knowledge in solving cognitive problems in the field of product and practical process development;

Skills: he can

To use knowledge in the field of materials engineering and mechanical engineering to creatively identify, formulate and innovative solving of complex problems in the selection of techniques for shaping different materials, in particular: define the goal and subject of scientific research, formulate a research hypothesis; develop methods, techniques and research tools and apply them creatively; conclude on the basis of the results of scientific research; perform critical analysis and evaluation of the results of scientific research, expert activities and other creative work as well as their contribution to the development of knowledge; transfer the results of scientific activity to the economic and social sphere;

Knowledge: he knows and understands

To the extent enabling revision of existing paradigms, global achievements in the field of production techniques and materials science, covering theoretical foundations and general issues and selected specific issues relevant to material engineering or scientific disciplines within which they are preparing a doctoral dissertation in the appropriate selection of material shaping techniques

Fundamental dilemmas of modern civilization in the field of producing new "non-technological" materials;

Economic, legal, ethical and other important conditions for scientific activity in the field of shaping new material groups
Student workload (ECTS credits balance)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Udział w zajęciach dydaktycznych/praktyka</td>
<td>15</td>
</tr>
<tr>
<td>Preparation for classes</td>
<td>10</td>
</tr>
<tr>
<td>Realization of independently performed tasks</td>
<td>5</td>
</tr>
<tr>
<td>Examination or Final test</td>
<td>1</td>
</tr>
<tr>
<td>Contact hours</td>
<td>2</td>
</tr>
<tr>
<td><strong>Summary student workload</strong></td>
<td><strong>33</strong></td>
</tr>
<tr>
<td><strong>Module ECTS credits</strong></td>
<td><strong>2 ECTS</strong></td>
</tr>
</tbody>
</table>

Additional information

Module content

Lectures

The student will learn about the principles of selection of manufacturing techniques for the production and shaping of products for four basic groups of materials: metals, polymers, ceramics and composites, depending on their properties. The basic features of the microstructure of materials obtained by such techniques as: metals forming, casting, sintering, machining and 3D additive methods will be discussed. Doctoral students learn about the phenomena and material defects resulting from the use of the above-mentioned techniques such as: strengthening, grain growth for various techniques, porosity, thermal stresses, casting defects, microstructure discontinuities, dendrites, macrosegregation, lack of adhesion and wettability. They learn destructive and non-destructive methods to assess the basic physical and mechanical properties of materials. They become acquainted with methods improving the state of microstructure and properties for individual production techniques, learn about technological treatments and new devices that eliminate material defects generated in individual production techniques. They learn about thermal treatments and methods of surface layer modification.

Lecture content:

1. Evaluation of the possibility of shaping products from the point of views the material properties: chemical bonds, crystal structure, defects, thermal and mechanical properties. The basic characteristics of the manufacturing techniques – 3 hours.
2. Foundry, casting defects, their detection, methods of repairing castings and prevention of foundry defects – 2 hours.
4. Metals forming, type of methods. Strengthening the material due to deformation, recovery and recrystallization, recrystallizing annealing – 2 hours.
5. Machining, conventional and non-conventional. Thermal stresses, surface quality, changes in the chemical composition of the surface layer. Selection of the method for processing for selected groups of materials- 2 hours.
6. 3D additive methods. Porosity and surface roughness, methods of improving the condition of the surface layer. Properties of products manufactured by 3 D methods –
Teaching methods and techniques:
Lectures: The content presented at the lecture is provided in the form of a multimedia presentation in combination with a classical lecture panel enriched with demonstrations relating to the issues presented.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:
Passing the lectures based on the finale test. Preferred presence at lectures.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:
Lectures:
- Attendance is mandatory: No
- Participation rules in classes: Students participate in the classes learning the next teaching content according to the syllabus of the subject. Students should constantly ask questions and explain doubts. Audiovisual recording of the lecture requires the teacher’s consent.

Method of calculating the final grade
The final grade is the test grade.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:
In the case of failure to write a test on the lecture content, for a justified reason, pass the colloquium at a different date agreed with the lecturer.

Prerequisites and additional requirements
Prerequisites and additional requirements not specified

Recommended literature and teaching resources

Scientific publications of module course instructors related to the topic of the module
L. Jaworska, J. Cyboroń, S.Cygan, J.Laszkiewicz-Łukasik, M. Podsiadło, P.Novak, Y.Holovenko
L. Jaworska, P. Putyra, P. Klimczyk, M. Zybura M. Nowe możliwości technologiczne i badawcze materiałów ceramicznych przeznaczonych na części maszyn i narzędzi. Mechanik, 2010, R. 83, nr 10, s. 710-713. (Serie Biuletyn). Agenda Wydawnicza SIMP. 2010 ISSN 0025-6552
A. Twardowska, B. Rajchel, L. Jaworska: Ion beam assisted deposition of Ti-Si-C thin films, Journal of Achievements In Materiale and Manufacturing Engineering, Vol. 37, (2009), iss.1, s.87-90

Additional information
None