

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Powder materials modified by boron

Academic year: 2019/2020 Code: ZSDA-3-0170-s ECTS credits: 3

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: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: dr hab. inż. prof. AGH Karwan-Baczewska Joanna (jokaba@agh.edu.pl)

Module summary

Presentation of mechanism of sintering process of iron powders and alloys powders with boron. Influence of boron on the microstructure and the properties of sintered materials alloyed by boron powders.

Description of learning outcomes for module

| MLO code | Student after module completion has the knowledge/ knows how to/is able to | Connections with FLO | Method of learning outcomes verification (form of completion) |
|-------------------------------------|---|---|---|
| Skills: he can | | | |
| M_U001 | students knows to project sintered parts on the base on metallic and alloyed powders | SDA3A_U07, SDA3A_U06, SDA3A_U03, SDA3A_U02, SDA3A_U01 | Scientific paper, Test, Activity during classes |
| Knowledge: he knows and understands | | | |
| M_W001 | Student knows different types of sintering proces of metallic and alloyed powders | SDA3A_W02, SDA3A_W01 | Scientific paper, Test, Activity during classes |
| M_W002 | Students knows the structure and properties of sintered materials | SDA3A_W03, SDA3A_W02, SDA3A_W07, SDA3A_W01 | Scientific paper, Test, Activity during classes |
| M_W003 | Student knows advance powder metallurgy technology and new trends in powder metallurgy technology | SDA3A_W02, SDA3A_W07, SDA3A_W01 | Scientific paper, Test, Activity during classes |

Number of hours for each form of classes

| Suma | Form of classes | | | | | | | | | | |
|------|-----------------|--------------------|--------------------|-----------------|----------------------|-----------------|-------------------|-------------------|-----------|-------------------------------|----------|
| | Lectures | Auditorium classes | Laboratory classes | Project classes | Conversation seminar | Seminar classes | Practical classes | Fieldwork classes | Workshops | Prace kontrolne i przejściowe | Lektorat |
| 16 | 8 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 |

FLO matrix in relation to forms of classes

| MLO code | Student after module completion has the knowledge/ knows how to/is able to | Form of classes | | | | | | | | | | |
|-------------------------------------|---|-----------------|--------------------|--------------------|-----------------|----------------------|-----------------|-------------------|-------------------|-----------|-------------------------------|----------|
| | | Lectures | Auditorium classes | Laboratory classes | Project classes | Conversation seminar | Seminar classes | Practical classes | Fieldwork classes | Workshops | Prace kontrolne i przejściowe | Lektorat |
| Skills: he can | | | | | | | | | | | | |
| M_U001 | students knows to project sintered parts on the base on metallic and alloyed powders | - | - | - | - | - | + | - | - | - | - | - |
| Knowledge: he knows and understands | | | | | | | | | | | | |
| M_W001 | Student knows different types of sintering proces of metallic and alloyed powders | + | - | - | - | - | + | - | - | - | - | - |
| M_W002 | Students knows the structure and properties of sintered materials | + | - | - | - | - | + | - | - | - | - | - |
| M_W003 | Student knows advance powder metallurgy technology and new trends in powder metallurgy technology | + | - | - | - | - | + | - | - | - | - | - |

Student workload (ECTS credits balance)

| Student activity form | Student workload |
|---|------------------|
| Udział w zajęciach dydaktycznych/praktyka | 16 h |
| Preparation for classes | 4 h |
| przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania | 4 h |
| Realization of independently performed tasks | 4 h |
| Examination or Final test | 1 h |
| Contact hours | 2 h |
| Summary student workload | 31 h |
| Module ECTS credits | 3 ECTS |

Additional information

Module content

Lectures

Introduction to powder metallurgy technology. Methods of obtaining metallic and alloys powders. Production of pre-alloyed powders. Compacting and sintering of pre-alloyed powders modified by boron. Influence of boron powder on the microstructure and the properties of different sintered materials. Mechanism of activated sintering of Fe, Austalloy and Distalloy materials.

Seminar classes

1. Production of metallic and alloys powders
2. Compacting and sintering of pre-alloyed powder with boron
3. Mechanism of sintering process of Fe and alloys powders with boron and borides
4. Effect of boron on the microstructure and the properties of different sintered materials.

Teaching methods and techniques:

Lectures: The content presented at the lecture is transmitted in the form of a multimedia presentation in combination with a classical lecture, enriched with demonstrations relating to the issues presented.

Seminar classes: Students actively participate in classes in the form of presentations on specific topics and participate in the discussion.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Passing the lecture based on the colloquium, passing the seminar on the basis of the prepared and delivered lecture.

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 keep on asking questions and explain concerns. Audiovisual recording of the lecture requires the teacher's consent.

Seminar classes:

- Attendance is mandatory: Yes

- Participation rules in classes: Students participate in the classes presenting, in the form of papers, issues they have developed regarding the syllabus program after previous consultations with the teacher

Method of calculating the final grade

Final grade will be issued on the basis of: colloquium, PhD students' activity during the classes and presentation of the paper at the seminar.

The final mark may be increased or decreased by half of the score for commitment and activity if possible.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

Arrears can be made up by prior arrangement with the teacher as part of an additional seminar period.

Prerequisites and additional requirements

absent

Recommended literature and teaching resources

1. German R.M. „Powder Metallurgy Science”, MPIF (1994)
2. Shatt W., Wieters K.P., “Powder Metallurgy Processing and Materials”, EPMA (1997)
3. German R.M., “Sintering Theory & Practice”, EPMA, (2005)
4. German R.M., “Powder Metallurgy & Particulate Materials Processing”, EPMA (2007).
5. J. Karwan-Baczewska, “The properties of Fe-Ni-Mo-Cu-B , materials produced via liquid phase sintering, Archives of Metallurgy and Materials”, vol. 56,3, (2011),789-796
6. J. Karwan-Baczewska, “Processing and properties of Distaloy SA sintered alloys with boron and carbon”, Archives of Metallurgy,vol.60, (2015), 41-45and others available

Scientific publications of module course instructors related to the topic of the module

1. J. Karwan-Baczewska, “Processing and properties of Distaloy SA sintered alloys with boron and carbon”, Archives of Metallurgy,vol.60, (2015), 41-452.
2. J. Karwan-Baczewska, “The properties of Fe-Ni-Mo-Cu-B , materials produced via liquid phase sintering, Archives of Metallurgy and Materials”, vol. 56,3, (2011),789-7964.
3. I. Sulima, L. Jaworska, J. KARWAN-BACZEWSKA “Effect of boron sinter-aid on the microstructure and properties of austenitic stainless steel-TiB₂ composites” Archives of Metallurgy and Materials, ISSN 1733-3490. — 2015 vol. 60 iss. 4, s. 2619-2624.

Additional information

absent