



COURSE CARD

1. Basic information

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|--|--|-------------------------------------|
| Course name in English: | Materials engineering in construction processes | |
| Course name in Polish: | Inżynieria materiałów w procesach konstrukcyjnych | |
| Number of hours: | 30 | |
| Type of course: | Elective course | |
| Form of course: | mixed forms (combination of lecture, seminar and laboratory) | |
| Code of course: | W02ILT-SD0137W / ILQ100437W | |
| Course leader: | Łukasz Sadowski | |
| Faculty of the course leader: | W2 Faculty of Civil Engineering | |
| Email address of the course leader: | lukasz.sadowski@pwr.edu.pl | |
| Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course): | Architecture and urban planning | <input checked="" type="checkbox"/> |
| | Automation, electronic, and electrical engineering | <input checked="" type="checkbox"/> |
| | Information and communication technology | <input type="checkbox"/> |
| | Biomedical engineering | <input checked="" type="checkbox"/> |
| | Chemical engineering | <input checked="" type="checkbox"/> |
| | Civil engineering and transport | <input checked="" type="checkbox"/> |
| | Mechanical engineering | <input checked="" type="checkbox"/> |
| | Environmental engineering, mining, and energy | <input checked="" type="checkbox"/> |
| | Mathematics | <input type="checkbox"/> |
| | Chemical sciences | <input checked="" type="checkbox"/> |
| | Physical sciences | <input type="checkbox"/> |
| | Management and quality studies | <input type="checkbox"/> |

2. Objectives

1. To acquaint with the principles of construction materials technologies in engineering.
2. To acquaint with the principles of adhesive bonding in materials engineering.
3. To acquaint with the principles of surface treatment of construction materials.
4. To gain skills of writing a section "materials" in the preparation of scientific publications.
5. To acquaint with the principles of laboratory methods used in materials characterization.
6. To acquaint with the principles of field methods used in materials characterization.
7. To acquaint with the principles of multi-scale characterization of materials in engineering.
8. To gain skills necessary to prepare and write a section "methods" in the preparation of scientific publications.



9. To gain basic knowledge in the field of the presentation and visualization of the obtained results in materials and construction engineering.

3. Content

Detailed information about the course content, including topics and form of classes.

| No. | Topic | Number of hours | Form of classes |
|-----|---|-----------------|-----------------|
| 1 | Construction materials technologies in engineering (cement-based materials, metals, polymers, ceramic materials, composite materials) | 4 | lecture |
| 2 | Adhesive bonding in materials engineering (theory of adhesion, methods, adhesive families and selection, applications and quality control, joint design) | 2 | lecture |
| 3 | Surface treatment of construction materials (methods, surface parameters, applications) | 2 | lecture |
| 4 | Preparation of a section "materials" for scientific publications | 2 | lecture |
| 5 | Laboratory methods used in materials characterization (optical methods, microscopic methods, radiographic methods, calibration, reliability of testing). Lecture and group discussion | 4 | lecture |
| 6 | Field methods used in materials characterization (semi-destructive testing methods, non-destructive testing methods, complementary use of methods) | 2 | lecture |
| 7 | Multi-scale characterization of materials in engineering (conception of multi-scale approach, examples and application) | 2 | lecture |
| 8 | Preparation of a section "methods" for scientific publications | 2 | lecture |
| 9 | Presentation and visualization of the obtained results in materials and construction engineering (drawing scientific charts, role of graphical abstract) | 2 | lecture |
| 10 | Delivering a multimedia presentation on a selected topic related to materials engineering in construction processes | 6 | seminar |
| 11 | Preparation of final report | - | Select form |
| 12 | Review of final report | 2 | seminar |
| 13 | Total hours | 30 | Select form |

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

1. Having a basic knowledge of a given discipline at the second level of studies.
2. Having a predefined research topic related to realized PhD thesis.
3. Having a basic knowledge on construction materials.



5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

| Symbol | Learning outcome | |
|--------|--|-------------------------------------|
| | KNOWLEDGE. Doctoral student knows and understands: | |
| SzD_W3 | the main trends in the development of the scientific or artistic disciplines covered in the curricula; | <input checked="" type="checkbox"/> |
| SzD_W4 | research methodology; | <input type="checkbox"/> |
| SzD_W5 | the rules for the dissemination of scientific results, including in open access mode; | <input type="checkbox"/> |
| SzD_W6 | the fundamental dilemmas of modern civilization; | <input checked="" type="checkbox"/> |
| SzD_W7 | the legal and ethical conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W8 | the economic and other relevant conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W9 | basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results. | <input type="checkbox"/> |
| | SKILLS. Doctoral student is able to: | |
| SzD_U2 | use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres; | <input checked="" type="checkbox"/> |
| SzD_U3 | communicate on specialised topics to the extent that they enable an active participation in the international scientific community; | <input checked="" type="checkbox"/> |
| SzD_U4 | disseminate research results, including in popular forms; | <input checked="" type="checkbox"/> |
| SzD_U5 | initiate debates and participate in a scientific discourse; | <input type="checkbox"/> |
| SzD_U6 | be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment; | <input type="checkbox"/> |
| SzD_U7 | plan and implement an individual or collective research or creative activity, including in an international environment; | <input checked="" type="checkbox"/> |
| SzD_U8 | independently plan and act for one's own development and inspire and organize the development of others; | <input type="checkbox"/> |
| SzD_U9 | plan classes or groups of classes and implement them using modern methods and tools. | <input type="checkbox"/> |
| | SOCIAL COMPETENCES. Doctoral student is ready to: | |
| SzD_K3 | fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way; | <input type="checkbox"/> |



| | | |
|--------|---|-------------------------------------|
| SzD_K4 | maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection. | <input checked="" type="checkbox"/> |
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6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Preparation of final report, delivering a presentation, activity in group discussion

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

Lecture, presentation, discussion, self work

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

1. Gonçalves, M. C., & Margarido, F. (2015). Materials for construction and civil engineering. Cham, Switzerland: Springer.
2. Sadowski, Ł. (2019). Adhesion in Layered Cement Composites. Cham, Switzerland: Springer.
3. Sadowski, Ł., & Hoła (2022) J. Non-Destructive Diagnostics of Concrete Floors: Methods and Case Studies. Boca Raton, CRC Press.
4. Mathia, T. G., Pawlus, P., & Wieczorowski, M. (2011). Recent trends in surface metrology. Wear, 271(3-4), 494-508.
5. Sadowski, Ł., Hoła, J., Czarnecki, L., & Mathia, T. G. (2021). New paradigm in the metrology of concrete surface morphology: Methods, parameters and applications. Measurement, 169, 108497.
6. Literature related to a particular scientific discipline.

9. Other remarks

Additional remarks, comments, (e.g., language of the course)

own laptop is welcome