



Politechnika  
Wroclawska

# Introduction

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Wroclaw University of Science and Technology  
Faculty of Civil Engineering  
Department of Materials Engineering and Construction  
Processes

# Course card

<b>Course name in English:</b>	<b>Materials engineering in construction processes</b>	
<b>Course name in Polish:</b>	Inżynieria materiałów w procesach konstrukcyjnych	
<b>Number of hours:</b>	30	
<b>Type of course:</b>	Elective course	
<b>Form of course:</b>	mixed forms (combination of lecture, seminar and laboratory)	
<b>Code of course:</b>		
<b>Course leader:</b>	Łukasz Sadowski	
<b>Faculty of the course leader:</b>	W2 Faculty of Civil Engineering	
<b>Email address of the course leader:</b>	lukasz.sadowski@pwr.edu.pl	
<b>Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course):</b>	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"/>	

# Prerequisites and learning outcomes

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.

Learning outcomes (knowledge):

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"/>



# Prerequisites and learning outcomes

## Learning outcomes (skills):

	<i>SKILLS. Doctoral student is able to:</i>	
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"/>

# Prerequisites and learning outcomes

## Learning outcomes (social competences):

SzD_K3	fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way;	
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.	

## Literature:

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

## Other remarks:

- Course in English, own laptop is welcome.

# Course objectives

- To acquaint with the principles of construction materials technologies.
- To acquaint with the principles of adhesive bonding in materials engineering.
- To acquaint with the principles of surface treatment of construction materials.
- To gain skills of writing a section “materials” in the preparation of scientific publications.
- To acquaint with the principles of laboratory methods used in materials characterization.
- To acquaint with the principles of field methods used in materials characterization.
- To acquaint with the principles of multi-scale characterization of materials in engineering.
- To gain skills necessary to prepare and write a section “methods” in the preparation of scientific publications.
- To gain basic knowledge in the field of the presentation and visualization of the obtained results in materials and construction engineering.

# Content of the course

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

# Course evaluation

## Scoring for a:

- presentation on a selected topic related to the materials engineering in construction processes (**P**, from 0 to 2 points),
- summary report (**R**, from 0 to 2 points),
- activity in group discussions (**Q**, 0.5 points for each question asked for the presentation, not more than 1 point for all questions asked; does not apply on the day of presentation).

$$\underline{\text{Course grade} = P+R+Q}$$

## Additional task to increase the grade by 0.5:

- Participation in additional school (e.g. winter school) in materials engineering,
- Preparation of scientific article based on the content of this class.



# Summary report

Should be prepared according to the table of contents below. The report should be sent in **PDF format (file size max. 2 MB) to the e-mail lukasz.sadowski@pwr.edu.pl** at the latest during the last class:

## 1. Construction materials technologies in engineering:

- Describe 3 main materials (or processes) used in your research using 3 keywords,
- Search for scientific articles in Scopus using combination of selected 3 keywords,
- Describe the content of 3 most cited articles based on your Scopus search.

## 2. Adhesive bonding in materials engineering:

- Describe main possibilities and phenomena of adhesive bonding between selected 3 materials (or combination of 3 processes) used your research,
- Search for scientific articles in Scopus related to the adhesive bonding (or combination of 3 processes) of your 3 selected materials (or processes),
- Describe the content of 3 most cited articles related to adhesive bonding (or combinations) based on your Scopus search.

# Summary report

## 3. Surface treatment of construction materials:

- Describe main 3 methods that may be used to treat the surface of 3 materials used your research,
- Search for scientific articles in Scopus using combination of selected 3 Methods and 3 materials,
- Describe the content of 3 most cited articles related to surface treatment based on your Scopus search.

## 4. Preparation of a section “materials”:

- Prepare a section “materials” for potential scientific publication to be prepared based on your research.

## 5. Laboratory methods used in materials characterization:

- Describe main 3 laboratory methods that may be used to characterize your 3 material (or processes) used your research,
- Search for scientific articles in Scopus using combination of selected 3 methods and 3 materials (or processes),
- Describe the content of 3 most cited articles related to laboratory methods used in materials characterization based on your Scopus search.

# Summary report

## 6. Field methods used in materials characterization:

- Describe main 3 field methods that may be used to characterize your 3 material (or processes) used your research,
- Search for scientific articles in Scopus using combination of selected 3 methods and 3 materials (or processes),
- Describe the content of 3 most cited articles related to field methods used in materials characterization based on your Scopus search.

## 7. Preparation of a section “methods”:

- Prepare a section “methods” for potential scientific publication to be prepared based on your research.

**Now: Round table introductions of your materials (processes) point of view**

Every student introduce shortly  
himself/herself

# Students with disabilities and special needs

Students who, due to their health condition, disability or other objective reasons, may have special needs related to classes leading, crediting method or materials preparation are asked to report for consultations or after the classes, write such information in a private chat or write an e-mail about the matter. I will try to ensure that during my classes everyone has an equal right to gain knowledge and its' crediting.