GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00070381		
Field of study	Materials Engineering, Materials Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Ceramics -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Aleksandra Mielewczyk-Gryń	
	Teachers	dr hab. inż. Aleksandra Mielewczyk-Gryń	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	9.0	0.0	0.0	0.0	0.0	9

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=4184

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	9	2.0	14.0	25

Subject objectives

The course aims to introduce students to the fundamental issues related to thermal analysis of materials. The classes cover the operating principles and application scope of selected thermal analysis methods, with particular emphasis on calorimetric and thermogravimetric techniques. The course enables students to understand how thermal analysis is used to assess the physicochemical properties of materials, identify phase transformations, and analyze the thermal stability of materials.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W06] Knows selected methods, techniques, tools and materials used in solving simple engineering problems within the scope of materials engineering.	The student is familiar with the basic thermal analysis techniques, including calorimetric methods (DSC, Calvet) and thermogravimetric methods (TGA). They understand the operating principles and applications of these methods in the evaluation of material properties, and possess knowledge of how to interpret thermal measurement results as well as an awareness of their limitations.	[SW1] Assessment of factual knowledge
	[K6_W02] has knowledge of physics and chemistry, useful for formulating and solving simple problems within the scope of materials science	The student possesses knowledge of physics and chemistry that enables them to formulate and solve simple problems in the field of thermal analysis of materials, particularly those related to the interpretation of physicochemical phenomena occurring during thermal processes and the evaluation of material properties based on thermal analysis results.	[SW1] Assessment of factual knowledge
	[K6_U02] Can operate typical laboratory equipment and analyze material tests	The student is familiar with methods for analyzing and processing data obtained from thermal analysis techniques, is able to interpret measurement curves, and can identify characteristic thermal effects such as phase transformations, chemical reactions, and decomposition processes, while taking into account measurement limitations and result uncertainties.	[SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>Course content – lecture

1. Introduction to Thermal Analysis

• Basic concepts and definitions
• Classification of thermal analysis methods
• Applications of thermal analysis in materials science

2. Thermal Analysis Techniques

• Thermogravimetry (TG): fundamentals, instrumentation, result interpretation
• Differential Scanning Calorimetry (DSC): operating principles, analysis of thermal effects
• Dynamic Mechanical Analysis (DMA): measurement of mechanical properties as a function of temperature
• Differential Thermal Analysis (DTA): characteristics and applications
• Thermomechanical Analysis (TMA): investigation of thermal expansion of materials

3. Instrumentation and Measurement Methods

• Description of the construction and operation of typical instruments
• Calibration and quality control of measurements
• Experimental conditions

4. Examples of Thermal Analysis Applications

• Studies of polymers, ceramics, metals, and alloys
• Phase characterization and thermal stability of materials
• Thermal degradation and kinetic analysis of decomposition processes

5. Data Interpretation and Analysis

• Processing thermal curves
• Influence of experimental conditions on results
• Computational methods and modeling of thermal processes

6. Practical Aspects of Thermal Analysis

• Planning and conducting experiments
• Discussion of measurement errors and factors affecting results
• Comparison of different thermal analysis methods

7. Modern Trends in Thermal Analysis

• Combining thermal analysis with other research techniques (e.g., FTIR spectroscopy, XRD)
• Application of artificial intelligence and big data analysis in result interpretation
• Innovative materials and technologies in thermal studies</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>critical text analysis - written summary</td><td>50.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>Introduction to thermal analusis Micheal E. Brown Kluwer Academic Publishers</td></tr><tr><td>Supplementary literature</td><td>Scientific papers from: Journal of Thermal Analysis and Calorimetry</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Analysis of a text related to a selected thermal analysis method in terms of its applicability for a given study</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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