GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065849		
Field of study	Materials Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Specialty subject group 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	3	ECTS credits	2.0
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 inż. Tadeusz Miruszewski	
	Teachers	dr inż. Tadeusz Miruszewski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	0.0	15

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/moodle/course/

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	15	2.0	33.0	50

Subject objectives

Acquiring knowledge about the phenomena, technologies and applications of thermoelectric materials.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W01] Has extended knowledge of the fields of science and scientific disciplines relevant to materials engineering, and their historical development and importance for the progress of exact and natural sciences, knowledge of the world and evolution of humanity.	Students understand the need to update knowledge regarding materials in order to design new sources of electrical energy.	[SW1] Assessment of factual knowledge
[K7_W03] Has extended and enhanced knowledge of mathematics, physics, chemistry and other fields, useful when formulating and solving problems within the scope of materials science.	Expanding knowledge of physical phenomena occurring in thermoelectric materials and their use in the design of efficient sources of electrical energy.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

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

1. Introduction to the subject, introductory information, historical outline.
2. Electrical transport in metals and semiconductors.
3. Seebeck effect microscopic description
4. Peltier effect microscopic description
5. Thomson effect microscopic description
6. Models of specific heat, phonon and electronic thermal conductivity
7. Design of thermoelectric materials introductory information, the concept of thermoelectric Figure of Merit ZT, efficiency η
8. Types of thermoelectric materials metals, group IV elements, group V and VI elements, phonon glasses, TAGS group, oxides
9. Application of thermoelectric materials thermoelectric modules, space engineering, nanotechnology and thermoelectricity</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of solid state physics and electronics, and physical chemistry.</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>Exam</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>[1] D.M. Rowe, CRC handbook of Thermoelectrics, CRC Press 1995

[2] J. Przyłuski, K. Borkowski, Materiały termoelektryczne, Wyd. PW, 1983

[3] K. Kurosaki et al. , Thermoelectric materials, Wyd. De Gruyter, 2020

[4] F.A. Kulacki, Handbook of Thermal Science and Engineering, Wyd. Springer, 2018</td></tr><tr><td>Supplementary literature</td><td>none</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>- Give a definition of thermoelectric Figure of Merit and discuss the temperature changes of parameters occurring in
ZT;
- Discuss the Seebeck effect using the example of a Cu-Ni metal junction;
- Give known methods of producing thermoelectric materials and discuss in more detail one selected method.
- Discuss the dependence of specific conductivity on temperature for an intrinsic semiconductor.
- Discuss the principle of operation of a radioisotope thermoelectric generator.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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