COURSE DESCRIPTION CARD - SYLLABUS

Course name
PHOTONIC MATERIALS FOR PHOTOWOLTAICS [S5IMAT>FMF]

Course

Proposed by Discipline
–

Year/Semester
3/6

Level of study
Doctoral School

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
8

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge in the field of experimental physics, optics, optoelectronics, electric properties of materials and materials engineering.

Course objective

1. Provide students with knowledge about the properties of the photonic materials used in photovoltaics. Photovoltaic materials directly convert solar energy into electricity by the photovoltaic effect leading to one of the solution on the increasing global energy demand. 2. Developing the ability of students to obtain information with the use of specialized scientific literature.

Course-related learning outcomes

Knowledge:
1. has knowledge of selected issues carried out during the lecture P8S_WG/SzD_W03, P8S_WK/SzD_W05,
2. knows the application of laws and phenomena in the scope of selected issues carried out during the lecture to describe phenomena in the surrounding world P8S_WG/SzD_W01.

Skills:
1. is able to see and explain some phenomena related photovoltaic effect and solar cells P8S_UW/

SzD_U01, P8S_UW/SzD_U02.

Social competences:
1. understands the need to expand knowledge in the field of selected problems carried out during the lecture in order to apply them in innovative solutions to technological, technical and engineering problems P8S_KK/SzD_K01, P8S_KK/SzD_K03.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The following assessment thresholds apply to the methods used to verify the learning outcomes achieved:
50.1-60% dst;
60.1-70% dst+;
70.1-80% db;
80.1-90% db+;
90.1% bdb.
Assessment is based on individual written work.

Programme content

Issues related to the properties of the selected photonic materials used in photovoltaics: crystalline rare earth doped materials used as optical converters in solar cells.

Course topics

1. Photovoltaic materials.
2. Optical spectroscopy: luminescence, up-conversion and down-conversion processes.
3. Solar Spectrum Converters.
4. Efficient near-infrared emission produced by selected rare earth doped crystalline phosphors.

Teaching methods

Lecture: multimedia presentation.

Bibliography

Basic:
1. A. Poman, M. Knight, E.C. Garnett, B. Ehrler, C. Sinke, Photovoltaic materials: present efficiencies and future challenges, (2016).
https://doi.org/10.1126/science.aad4424
2. W.G.J.H.M. van Sark, A. Meijerink, R.E.I. Schropp, J.A.M. van Roosmalen, E.H. Lysen, Enhancing solar cell efficiency by using spectral converters, Sol. Energy Mater. Sol. Cells., 87 (2005) 395–409.
https://doi.org/10.1016/j.solmat.2004.07.055.
3. W.G.J.H.M. Van Sark, A. Meijerink, R.E.I. Schropp, Third Generations Photovoltaics. (2012)
https://doi.org/10.5772/39213

Additional:
4. T. Zhezhera, P. Gluchowski, M. Nowicki, M. Chrunik, A. Majchrowski, K. M. Kosyl and D. Kasprowicz, Efficient near-infrared quantum cutting by cooperative energy transfer in Bi3TeBO9:Nd3+ phosphors, Journal of Materials Science, 57 (2022) 185–203.
5. T. Zhezhera, P. Gluchowski, M. Nowicki, M. Chrunik, A. Majchrowski and D. Kasprowicz, Enhanced near-infrared emission of Er3+ as a synergistic effect of energy transfers in Bi3TeBO9:Yb3+/Er3+ phosphors, Journal of Luminescence, 258 (2023) 119774.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	8	0,00
Doctoral student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation)	42	2,00