COURSE DESCRIPTION CARD - SYLLABUS

Course name
Carbon nanostructures [S2FT2>NW]

Course

Field of study
Technical Physics

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of molecular physics, solid-state physics, and materials engineering.

Course objective

Introducing students to the fundamental concepts of carbon nanostructures as a broad collection of materials with immense application potential.

Course-related learning outcomes

Knowledge:
Student possesses in-depth, theoretically grounded knowledge of mathematics, physics, and chemistry, useful for describing and analyzing processes and physical systems relevant to solving technical problems.
Student possesses in-depth, theoretically grounded knowledge of the characterization and fabrication of functional materials at the nanoscale and their potential applications in modern technology.
Student is familiar with the achievements, challenges, and limitations of selected advanced topics in physics and physical chemistry that are applied in modern technologies.

Skills:
Student is capable of selecting advanced and novel materials with appropriate physicochemical and structural properties for standard and non-standard laboratory and engineering applications relevant to the field of Technical Physics.
Student is able to adapt the achievements described in the literature in physics to technical applications.
Student can gather information from literature and databases regarding the properties of carbon nanostructures, perform critical analysis, integrate the data, and formulate opinions in areas relevant to the field of Technical Physics.

Social competences:
Student is ready to act in accordance with the principles of professional ethics, including responsibility for the reliability of the results obtained from his work and their interpretation, as well as the evaluation of others' work; Student is aware of the importance of behaving in a professional manner; Student is responsible for the safety of his own work and that of the team

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

50,1-60% dst;
60,1-70% dst+;
70,1-80% db;
80,1-90% db+;
od 90,1% bdb.
The grade is based on individual written work and an oral response.

Programme content

Types, methods of production, properties, and applications of carbon nanostructures; characterization methods for nanostructures; composites and thin films of carbon nanostructures; toxicity, recycling, and sustainability of carbon nanostructures.

Course topics

1. Description of the development of technology for obtaining carbon nanostructures.
2. Carbon as a building element in nanotechnology.
3. Safety and toxicity of carbon nanostructures.
4. Overview of basic methods for characterizing carbon nanostructures.
5. Fullerenes - types, methods of production, properties, current and potential applications.
6. Carbon nanotubes - types, methods of production, properties, current and potential applications.
7. Graphene/graphene flakes/graphene oxide - types, methods of production, properties, current and potential applications.
8. "Exotic" carbon nanostructures (nanohorns, quantum dots, graphynes, etc.) - types, methods of production, properties, current and potential applications.
9. Composites of carbon nanostructures - types, methods of production, properties, current and potential applications.
10. Thin films of carbon nanostructures - types, methods of production, properties, current and potential applications.
11. Hybrid materials with carbon nanostructures - types, methods of production, properties, current and potential applications.
12. Recycling and sustainability in carbon nanotechnology.

Teaching methods

Lecture: multimedia presentation.

Bibliography

Basic:
- A. Huczko, M. Kurcz, M. Popławska, "Nanorurki węglowe. Otrzymywanie, charakterystyka, zastosowania" Wydawnictwa Uniwersytetu Warszawskiego 2014
- A. Huczko, M. Bystrzejewski, "Fulereny 20 lat później" Wydawnictwa Uniwersytetu Warszawskiego

2007
- A. Dąbrowska, A. Huczko, M. Kurcz, "Grafen. Otrzymywanie, charakterystyka, zastosowania" Wydawnictwa Uniwersytetu Warszawskiego 2016

Additional:
Scientific reports presented during lectures.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	10	0,50