COURSE DESCRIPTION CARD - SYLLABUS

Course name

Nanocarbons and carbon/polymer composites

Course

Field of study

Chemical Technology

Year/Semester

I/1

Area of study (specialization)

Composites and Nanomaterials

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

English

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

45

Other (e.g. online)

Tutorials

0

Projects/seminars

15

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

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Faculty of Chemical Technology

Institute of Chemistry and Technical Electrochemistry

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Responsible for the course/lecturer:

Prerequisites

Basic knowledge of general chemistry, physical chemistry, inorganic chemistry, materials science. Ability to obtain information from indicated sources.

Course objective

The aim of the lecture is to supply knowledge on nanoporous carbons, graphenes, carbon nanotubes, fullerenes, carbon/polymer composites and practical application of nanomaterials and their composites.

Course-related learning outcomes

Knowledge

K_W3 - has improved knowledge of complex chemical processes with a suitable selection of materials, resources, methods, techniques and characterization of obtained materials

K_W6 - has improved knowledge of the newest chemical and material technologies, knows current trends in the development of chemical industrial processes

K_W11 - has well-grounded and improved knowledge of selected speciality (nanocarbons, carbon/polymer composites)

K_W14 - has knowledge of selected aspects of modern chemical knowledge

Skills

K_U1 - has the ability to obtain and critically evaluate information from the literature, databases and other sources, and formulate opinions on this basis

K-U3 - is able to communicate in English for professional contacts

K_U12 - has the ability to adapt knowledge about chemistry and related fields to solve problems in the field of chemical technology and planning new industrial processes

K_U15 - is able to critically analyze industrial chemical processes and introduce modifications and improvements in this area, using the acquired knowledge, including knowledge about the latest achievements of science and technology

Social competences

K_K1 - is aware of the need for lifelong learning and professional development

K_K2 - is aware of the limitations of science and technology related to chemical technology, including environmental protection

K_K6- is able to think and act creatively

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written/oral exam graded on the basis of a points system (0-100 points)

3	50.1 -70.0 points
4	70.1 -90.0 points
5	90.1 -100 points

Programme content

1. General characteristics of carbon materials. Effect of hybrydization.

2. Chemical and physical properties of carbon materials: microtexture, structure, conductivity, chemical reactivity, mechanical strength.

3. Elaboration of nanomaterials: catalytic method, chemical vapor deposition, template technique, mechanical milling and others.

4. Graphite, carbon nanotubes, graphenes, fullerenes, quantum dots.

5. Parameters which determine effective and large-scale production of nanostructures such as a type of catalyst and its support, temperature, precursor.

6. Chemical and physical activation of carbon materials for development of specific surface area.

7. Carbon/polymer composites: preparation, characterization, application.

8. Biocompatibility of nanomaterials, eventual health risk, safety and ecological problems.

9. Practical application of advanced carbon materials.

Laboratories provide an introduction to basic techniques used in experimental chemistry. Proper laboratory procedures, chemical safety rules, and environmentally safe methods of chemical disposal and waste minimization are important components of the course. Experiments are selected to provide illustration and reinforcement of course topics.

Teaching methods

Lecture: multimedia presentation illustrated with examples shown on a blackboard. Films.

Laboratory and project exercises.

Bibliography

Basic

1. Harry Marsh, Francisco Rodriguez Reinoso, Activated Carbons, Elsevier, 2006.

2. Carbon Nanomaterials eds. Y. Gogotsi, V. Presser, CRC Press, Boca Raton, FL, USA, 2010

3. Chemistry and Physics of Carbon ed. L.R. Radovic, Marcel Dekker, New York, 2001

4. Michio Inagaki, New Carbons - Control of Structure and Functions, Elsevier, 2000.

5. Nanomaterials Handbook ed. Y. Gogotsi, CRC, Taylor and Francis, Boca Raton, FL, USA, 2014

6. Sciences of Carbon Materials, eds. Harry Marsh, Francisco Rodriguez Reinoso, Universidad de Alicante, 2000.

7. Adsorption by Carbons eds. E.J. Bottani, J.M.D. Tascon, Elsevier, 2008.

Additional

1. Carbon Materials – Theory and Practice, ed. A.P. Terzyk, P.A. Gauden, P. Kowalczyk, Research Signpost, Kerala, India, 2008.

2. B. Roop Chand, G. Meenakshi, Adsorpcja na węglu aktywnym, WNT Warszawa, 2009

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) [1]	50	2,0

[1] delete or add other activities as appropriate