

Name: Solid state chemistry (C-PS.II1-SsCH)

Name in Polish:

Name in English: Solid state chemistry

Information on course:

Course offered by department: Faculty of Chemistry

Course for department: Faculty of Chemistry

Default type of course examination report:

Examination

Language:

English

Course homepage:

<http://www.katedrachf.umcs.lublin.pl>

Description:

The module covers the knowledge in the area of:

Lecture:

Chemical bonds in solids. Structure of solids: basics of electron structure of solid state, crystals, amorphous solids – glasses, polymers. Defects of solid structure: point, line, planar and bulk defects, effect of dopants on physicochemical properties of solids, equilibrium states of defects. Surfaces of solids: structure and properties of surface layers, surface energy, phenomena occurring at solid/solid interface. Phase equilibria and transitions of solids: phase rule, phase diagrams, phase transitions, thermodynamics of mixing, deviations from equilibrium, processes of nucleation and crystallization. Reactions in solid phase: reaction types, processes of diffusion and their mechanisms, mechanism and kinetics of oxidation, processes of sintering, decomposition of solids, mechanism and kinetics of reactions between solids.

Laboratory:

Synthesis and characterization of pure and doped mesoporous silica materials

Synthesis and characterization of carbonaceous materials

Estimation of total heterogeneity of solids by using the thermal analysis

Investigation of surface properties of mesoporous materials by using different thermogravimetric and microgravimetric methods

Investigation of structural properties of materials by using the method of adsorption/desorption of nitrogen

Investigation of solid surfaces by using the UV-Vis spectrophotometry in reflectance mode

Investigation of acid/base properties of materials by using the method of potentiometric titration

Investigation of adsorption processes on surfaces of carbonaceous and silica materials

Bibliography:

Literature:

1. H.R. Allcock, Introduction to materials chemistry, Wiley, New Jersey 2008
2. R. J. Naumann, Introduction to the physics and chemistry of materials, CRC Press, Boca Raton 2009
3. S. Zhang, L. Li, A. Kumar, Materials characterization techniques, CRC Press, Boca Raton 2009
4. J.N. Lalena, D.A. Cleary, E.E. Carpenter, N.F. Dean, Inorganic materials - synthesis and fabrication, Interscience, New Jersey 2008
5. J. Dereń, J. Haber, R. Pampuch, Chemia ciała stałego, PWN, Warszawa 1997
6. F. Paulik, Special Trends in Thermal Analysis, J. WilleySons, Chichister (1995)
7. I. Gregg and K. S. Sing, Adsorption, Surface Area and Porosity, 2nd ed., Academic Press, New York (1982)

Learning outcomes:

KNOWLEDGE

W1. Has knowledge to describe a role of chemistry in interdisciplinary studies on synthesis and characterization of new materials. K_W01

W2. Has knowledge to describe and analyze the types of solid defects and their influence on material properties. K_W01

W3. Has knowledge to identify and analyze the phase transitions in solids, to characterize the phase diagrams. K_W01

W4. Has knowledge to characterize the chosen types of processes in solids. K_W01

W5. Has knowledge to explain the basics of electron structure of solid state. K_W07

SKILLS

U1. Can identify and analyze the phase transitions in solids, characterize the phase diagrams. K_U01

U2. Can analyze and interpret different experimental dependences. K_U01

U3. Can select the appropriate methods of analysis of solid properties. K_U01

ATTITUDES

K1. Understand creativity and ability of interdisciplinary thinking and science role in civilization development. K_K06

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Contact hours (work with an academic teacher)

Lecture 15 hrs

Laboratory 15 hrs

Total number of hours with an academic teacher

30hrs

Number of ECTS points with an academic teacher

1

Non-contact hours (students' own work)

Preparation for laboratory 10 hrs

Literature studies 10 hrs

Reports from exercises 10 hrs

Preparation and participation in tests 10 hrs

Preparation and participation in exam 20 hrs

Total number of non-contact hours

60

Number of ECTS points for non-contact hours

2

Total number of ECTS points for the module

3

Consultations 15 hrs

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Written examination - W1, W2, W3, W4, W5, U1, K1

Oral test - W1, W3, W4, U1, U2, U3, K1

Reports from exercises – W1, W4, U2, U3

Activity - K1

Requirements

Advanced level of General Chemistry and Physical Chemistry

Course credits in various terms:**<without a specific program>**

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	3	15/16	