GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Solid state physicochemistry, PG_00052984		
Field of study	Chemistry in Construction Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study 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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Inorganic Chemistry -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jarosław Chojnacki	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	0.0	0.0	0.0	60

E-learning hours included: 0.0

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	60	20.0	70.0	150

Subject objectives: Student gets knowlegde on physical chemistry of solids

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W01	has wide and deep knowledge in scope of mathematics, physics, chemistry and crystallography used for description of materials used in contemporary construction industry	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
K7_U07	can choose appropriate research method for determination of desired properties of materials. Knows strong and weak sides of the methods	[SU5] Assessment of ability to present the results of task
K7_W06	student has solid and deep knowledge on advanced methods for determination of structure and physical properties of materials	[SW1] Assessment of factual knowledge
K7_W03	has wide and deep knowledge in scope of solid state chemistry, structure and bonding in solids, interpretation of phenomena characteristic for solids, in particular about properties of new materials applied in contemporary technology	[SW1] Assessment of factual knowledge

Subject contents	General description of solids and their structure. Thermodynamic function for crystalline solids, lattice energy, Born-Haber cycle. Vibrations in crystals: Einstein model nad Deby'e model of lattice vibrations, fonons. Outline of band model of electronic structure of solids. First Brillouine zone, direct and indirect band gaps. Imperfections of solids. Dislocations, point defects. Equilibrium concentration of intrinsic defects. Solid solutions, modulated structures, superstructures. Chemical compounds with non-integral coefficients. Kroeger and Vink symbols for defects. Brouwer diagrams. Transport of atoms. Fick's laws, Kirkendall fenomenon. Basic calculations of diffusion, Boltzmann-Matano method.for determination od diffusion coefficients in binary systems. Conductivity of solids, solid electrolytes. One- and two-dimensional solids, synthetic metals, intercalation of graphite and TiS2. Thermochromism and electrochromism. Magnetic properties of solids, Curie-Weiss law. Piesoelectric, ferroelastic and pyroelctric effects. Hydrophobic and Hydrophilic effects, the contact angle and wettability of a surface. Preparative methods in solid state chemistry: sol-gel, microwave, high-pressure, applying precursors. Rate of solid state reactions, morphology of products. Infuence of structural defects on rate of reaction. The role of interfacial surface in reaction kinetics. Basics of crystal growth theory.
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquia + presentation	60.0%	50.0%
Written exam	51.0%	50.0%

Recommended reading	Basic literature	L. Smart and E. Moore, *Solid State Chemistry*, Taylor & Francis Group, 2005 H. Kittel, Wstęp do Fizyki Ciała Stałego, Wyd. Naukowe PWN, 2012 H. Schmalzried, *Reakcje w ciele stałym*, PWN 1978 lub wydania późniejsze
	Supplementary literature	H. Mehrer, Diffusion in Solids: Fundamentals, Method,Materials, Diffusion-Controlled Processes, Springer-Verlag,Berlin Heidelberg, 2007 J. Dereń, J.Haber, R. Pampuch, *Chemia ciała stałego*, PWN, Warszawa 1975. N.B. Hannay, *Chemia Ciała Stałego*, PWN Warszawa 1972
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Explain why ionic conductivity of pure KCl is smaller than KCl doped with $SrCl_2$. Draw schematically relation log(sigma) = f(1/T) for both materials. 2. During diffusion experiment, in semi-infinite system of copper and brass, neutral markers (tungsten wires) placed between the phases drift towards brass. What do we call this phenomenon? Which partial diffusion coefficient is higher (D_{Zn} or D_{Cu})? Is this an example of interstitial diffusion or vacancy diffusion mechanism? 3. Determination of diffusion coefficient D(c) by the Boltzmann-Matano method.	
Work placement	Not applicable	