GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Organometallic Chemistry , PG_00053214		
Field of study	Chemistry		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Optional subject group 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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Inorganic Chemistry -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Rafał Grubba	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	15.0	45

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	45	5.0	25.0	75

Subject objectives

The aim of the course is to familiarize students with the structure, properties and applications of coordination compounds with particular emphasis on organometallic compounds.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U02] can work individually and in a team; he/she can assess the necessary task time and plan and organize individual work and in a small team in a way that ensures the execution of the task within a set deadline	The student is able to independently plan the synthesis of organometallic compounds. In addition, he can cooperate with other students in the implementation of tasks related to the synthesis and identification of organometallic compounds.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
K6_W02	The student has knowledge of the structure and chemical properties of organometallic compounds.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K6_U03] can make detailed documentation of the results of self-conducted experiments and prepare a report describing these results	The student is able to prepare a concise report describing the syntheses of organometallic compounds made.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
K6_W03	The student is able to predict the properties of organometallic compounds on the basis of their electronic structure.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

Subject contents	**LECTURE:**Coordination unions:- Basic concepts- Nomenclature of complex compounds- Equilibrium in solutions of complex compounds- Isomerism of complex compounds- Crystalline field theory- Color and magnetic properties of the d-block metal complexesOrganometallic compounds:-Phosphines as ligands-N-heterocyclic carbenes as ligands-Metal carbonyls-Alkenes as ligands- Aromatic hydrocarbons as ligands-Organolithium and organomagnesium compounds-Organic boron compounds- Organosilicon compounds-Basics of preparation of organometallic compounds **SEMINAR:**Importance of organometallic compounds in chemical synthesis, catalysis, material chemistry and medicine:Metal complexes with phosphines (synthesis and catalytic properties);Organophosphorus and organophosphorus compounds (synthesis and use as plant protection products or in medicine);Metal carbonyls (synthesis and catalytic properties; application in medicine);Metal complexes with unstable carbenes (synthesis and catalytic properties);Metal and non-metal complexes with N-heterocyclic carbenes (synthesis and catalytic properties, application in medicine);Cyclopentadienyl metal complexes (synthesis and catalytic properties; application in medicine);Organolithium compounds (synthesis);Organomagnesium compounds (synthesis);Organo-boron compounds (synthesis and catalytic properties);Organoaluminum compounds (synthesis and catalytic properties);Organosilicon compounds (synthesis and application);Nobel Prizes in Organometallic Chemistry;Metal clusters - discussion of selected examples;Organometallic polymers - discussion of selected examples **LABORATORY:**Synthesis of transition metal compounds containing cyclopentadienyl, olefin, phosphine and carbene ligands.
Prerequisites and co-requisites	Basic knowledge of general and inorganic chemistry (subjects "General Chemistry" I sem., "Inorganic Chemistry" II sem.).
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture - test	60.0%	40.0%
Seminar - presentation	60.0%	30.0%
Laboratory - test, report	60.0%	30.0%

Recommended reading	Basic literature	- P. Atkins, L. Jones, Chemia Ogólna, PWN - A. Bielański, Podstawy Chemii Nieorganicznej, PWN - B. D. Gupta, A. J. Elias, Basic organometallic chemistry. Concepts, syntheses and aplications, Universities Press
	Supplementary literature	- D. Astruc, Organometallic chemistry and catalysis, Springe
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	• Phosphines and amines are important ligands in coordination chemistry. Give one example each for phosphine and amine. Give their names, the Lewis formula, the shape of the molecule, and the hybridization of the nitrogen and phosphorus atom. Determine whether these compounds are oxidized by air. Write the Lewis formula for the oxidation products. Describe how phosphines and amines bind to transition metal ions (describe the similarities and differences in the nature of the bonds). • The following pairs of complexes are given. Determine which of the complexes is more stable in a given pair using the Lewis theory of soft and hard acids. Justify your answer. Give names for the listed complexes. $[FeF_6]^{3-}$ i $[FeCl_6]^{3-}$ $[HgI_4]^{2-}$ i $[HgCl_4]^{2-}$ $[Pt(NEt_3)_4]$ i $[Pt(PEt_3)_4]$ • Describe the structure and methods of NHC-carbene preparation on the example of a selected carbene.	
Work placement	Not applicable	

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