GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Technological and functional properties of plastics, PG_00060799						
Field of study	Chemical Technology						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2026/2027			
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	3		Language of instruction	Polish			
Semester of study	6		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Department of Polymer Technology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Justyna Kucińska-Lipka				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		2.0		18.0	50
Subject objectives	The aim of the course is to acquaint the student with the basic study of the physical, chemical , technological and functional properties of polymers.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U02] is able to operate typical laboratory apparatus and conduct analyses related to materials testing	The student is able to operate laboratory and measuring equipment for characterizing the properties of plastics.	[SU4] Assessment of ability to use methods and tools
[K6_K05] is aware of the social role of a technical university graduate, and in particular understands the need to formulate and communicate to the public, in particular through the mass media, information and opinions on the achievements of technology and other aspects of engineering activity	The student demonstrates a commitment to promoting knowledge about plastics by communicating their properties, applications, and social significance in a manner tailored to the audience.	[SK2] Assessment of progress of work [SK4] Assessment of communication skills, including language correctness
[K6_W02] has knowledge of inorganic, organic, physical and analytical chemistry useful for obtaining selected groups of compounds, determining their physical and chemical properties allowing for their quantitative and qualitative analysis, making measurements and determining the parameters of chemical reactions, phenomena and processes occurring in chemical technology	The student understands how laboratory and measuring equipment used to study the characteristics and properties of plastics works, drawing on knowledge of organic, physical, and analytical chemistry.	[SW1] Assessment of factual knowledge
[K6_K02] understands the non-technical aspects and implications of the activities of a chemical engineer, including the impact on the environment, is aware of professional behaviour, observance of professional ethics and respect for diversity of views and cultures	The student understands and can describe the impact of the plastics industry on human health, life, and the environment. The student conducts himself/herself professionally and is aware of the importance of professional ethics and respect for the views of others.	[SK2] Assessment of progress of work
[K6_W09] has knowledge of the technological and functional properties of polymers, the physical basis and processing methods of polymers and rubber	The student describes the technological and functional properties of polymers. The student can list and describe the basic methods of polymer processing.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture

- Introduction (types of properties of polymeric materials, their nature and specificity in relation to low-molecular-weight materials)
- Determination of molecular weights and their distribution (fractionation methods, end-group analysis, vapor and membrane osmometry, light scattering, sedimentation, viscometry, gel permeation chromatography)
- Test methods and apparatus for determining the physicomechanical properties of various polymer varieties (thermoplastics, elastomers, thin films, foams): static and dynamic tensile, compression, and bending tests, hardness, abrasion resistance, impact strength, density
- Characterization of the supramolecular structures of polymers (thermal, X-ray, and microscopic methods)
- Apparatus and methods for testing the thermal properties of polymers (thermophysical and thermomechanical stability of polymers, determination of polymer flammability)
- Polymer test methods for specific non-standard applications (biodegradability, sterility, and other tests).

Course content – laboratory

- Thermal Analysis of Plastics
- Studying the Crystallization Kinetics of Polymers
- Determination of Average Molecular Weights and Dispersion Coefficients: Gel Permeation Chromatography
- Static Tensile Testing Morphology of Polymers and Composites: Scanning Electron Microscopy

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture (written exam)	60.0%	60.0%
Laboratory (entry tests, reports, attendance and activity)	60.0%	40.0%

Recommended reading	Basic literature	• J.F. Rabek: Współczesna wiedza o polimerach. Tom 1: Budowa strukturalna polimerów i materiały badawcze, PWN, Warszawa 2017 • J.F. Rabek: Współczesna wiedza o polimerach. Tom 2: Polimery naturalne i syntetyczne, otrzymywanie i zastosowania, PWN, Warszawa 2017 • G.W. Ehrenstein, Ż. Brocka-Krzemińska: Materiały polimerowe: Struktura, właściwości, zastosowanie, PWN, Warszawa 2016
	Supplementary literature	Standards for testing of physical, chemical and mechanical properties of plastics (ASTM, DIN, ISO)
	eResources addresses	
Example issues/ example questions/ tasks being completed	• Show graphically the molecular weight distribution for monodisperse and polydisperse polymers (with a wide and narrow molecular weight distribution). Draw on one of the selected curves the approximate location of the Mn i Mw. • How can the molecular weight of polymers be determined based on osmometric studies. • Characterize the method for determining the molecular mass of polymers based on the GPC technique (Gel permeation chromatography). • Present the characteristics of the curve stress vs. elongation for the tensile test of any chosen material. Present on this curve what parameters can be determined in the subsequent stages of the tensile test. • Describe any chosen method of testing the susceptibility of polymer materials to the cracks (the so-called brittleness of the material). • Amorphous and crystalline polymer: how they differ, how to determine the degree of crystallinity of crystalline polymers. • Characterization of thermal properties of polymers and their connection with plastics processing. • Present the difference in the operation works of the extruder and injection molding machine. Replace 3 products that can be produced by injection molding and extrusion. • Based on the selected physical, chemical and functional properties, determine what type of material may have such properties. • For the indicated type of polymer, list physical, chemical, functional, processing and manufacturing properties as well as the scope of application.	
Practical activites within the subject	Not applicable	

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