



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 2023	Academic year of realisation of subject			2025/2026		
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	dr hab. inż. Justyna Kucińska-Lipka dr hab. inż. Michał Strankowski dr inż. Paulina Parcheta-Szwindowska dr inż. Maciej Sienkiewicz dr inż. Ewa Głowińska dr inż. Krzysztof Formela mgr inż. Przemysław Gnatowski					
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						
	eNauczenie source addresses: Moodle ID: 4405 2025/2026 - Właściwości technologiczne i użytkowe tworzyw sztucznych https://enauczanie.pg.edu.pl/2025/course/view.php?id=4405						
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_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 knows and is able to describe the operating principle of laboratory and measuring equipment for characterizing the properties of plastics, using knowledge of organic, physical and analytical chemistry.	[SW1] Assessment of factual knowledge
	[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_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 knows and can list and characterize the technological and functional properties of polymers. The student can list and characterize basic polymer processing methods.	[SW1] Assessment of factual knowledge
	[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 is ready to popularize knowledge about the properties, applications, and importance of plastics for society, in a manner adapted to users with different levels of technical expertise.	[SK2] Assessment of progress of work [SK4] Assessment of communication skills, including language correctness
Subject contents	<p>Course content – lecture</p> <ul style="list-style-type: none"> • 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 physicomaterial 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). <p>Course content – laboratory</p> <ul style="list-style-type: none"> • 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
	Laboratory (entry tests, reports, attendance and activity)	60.0%	40.0%
	Lecture (written exam)	60.0%	60.0%

Recommended reading	Basic literature	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 M_n i M_w. 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 activities within the subject	Not applicable	

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