



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 2025	Academic year of realisation of subject			2027/2028		
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_K02] is aware of the responsibility for his/her work and is ready to work in a team and share responsibility for common tasks.		The student is prepared to collaborate effectively within a laboratory team and to carry out assigned tasks in a responsible and professional manner.		[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work		
	[K6_W02] Possesses the chemical knowledge necessary to synthesize, analyze and evaluate the properties of compounds and processes used in chemical technology.		The student lists and describes the technological and functional properties of polymers, as well as the basic methods of polymer processing. The student has the knowledge to describe how laboratory and measuring equipment used to characterize the properties of plastics works.		[SW1] Assessment of factual knowledge		
	[K6_U02] Performs design calculations of technological processes, selects industrial equipment, operates laboratory equipment and conducts material analyses		The student is able to operate laboratory and measuring equipment for characterizing the properties of plastics.		[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		

Subject contents	<p>Course content – lecture</p> <ul style="list-style-type: none"> <li>• Introduction (types of properties of polymeric materials, their nature and specificity in relation to low-molecular-weight materials)</li> <li>• Determination of molecular weights and their distribution (fractionation methods, end-group analysis, vapor and membrane osmometry, light scattering, sedimentation, viscometry, gel permeation chromatography)</li> <li>• 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</li> <li>• Characterization of the supramolecular structures of polymers (thermal, X-ray, and microscopic methods)</li> <li>• Apparatus and methods for testing the thermal properties of polymers (thermophysical and thermomechanical stability of polymers, determination of polymer flammability)</li> <li>• Polymer test methods for specific non-standard applications (biodegradability, sterility, and other tests).</li> </ul>		
	<p>Course content – laboratory</p> <ul style="list-style-type: none"> <li>• Thermal Analysis of Plastics</li> <li>• Studying the Crystallization Kinetics of Polymers</li> <li>• Determination of Average Molecular Weights and Dispersion Coefficients: Gel Permeation Chromatography</li> <li>• Static Tensile Testing Morphology of Polymers and Composites: Scanning Electron Microscopy</li> </ul>		
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"> <li>• J.F. Rabek: Współczesna wiedza o polimerach. Tom 1: Budowa strukturalna polimerów i materiały badawcze, PWN, Warszawa 2017</li> <li>• J.F. Rabek: Współczesna wiedza o polimerach. Tom 2: Polimery naturalne i syntetyczne, otrzymywanie i zastosowania, PWN, Warszawa 2017</li> <li>• G.W. Ehrenstein, Ż. Brocka-Krzemińska: Materiały polimerowe: Struktura, właściwości, zastosowanie, PWN, Warszawa 2016</li> </ul>	
	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"> <li>• 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 <math>M_n</math> i <math>M_w</math>.</li> <li>• How can the molecular weight of polymers be determined based on osmometric studies.</li> <li>• Characterize the method for determining the molecular mass of polymers based on the GPC technique (Gel permeation chromatography).</li> <li>• 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.</li> <li>• Describe any chosen method of testing the susceptibility of polymer materials to the cracks (the so-called brittleness of the material).</li> <li>• Amorphous and crystalline polymer: how they differ, how to determine the degree of crystallinity of crystalline polymers.</li> <li>• Characterization of thermal properties of polymers and their connection with plastics processing.</li> <li>• 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.</li> <li>• Based on the selected physical, chemical and functional properties, determine what type of material may have such properties.</li> <li>• For the indicated type of polymer, list physical, chemical, functional, processing and manufacturing properties as well as the scope of application.</li> </ul>		
Practical activities within the subject	Not applicable		

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