



## Subject card

Subject name and code	Technological and Practical Properties of Polymers, PG_00048564						
Field of study	Chemical Technology						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2022/2023		
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			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Polymers Technology -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Maciej Sienkiewicz					
	Teachers	dr inż. Maciej Sienkiewicz dr hab. inż. Justyna Kucińska-Lipka dr inż. Marcin Włoch					
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	0.0	30
	E-learning hours included: 0.0 Address on the e-learning platform: <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22184">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22184</a>						
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		43.0		75
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_W09	During the course, the student acquires knowledge of the basic physical, chemical and mechanical properties of polymer materials and their use in order to characterize the technological and functional properties of plastic products. During the course, the student also gets to know the basic methods, techniques, and tools used to determine the technological and functional properties of polymers.			[SW1] Assessment of factual knowledge		
	K6_U07	Student can use the knowledge related to methods of polymer processing on an industrial scale, knows and is able to distinguish and select devices used for the production of specific utility products.			[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject		
Subject contents	1. Introduction (types of polymer properties, macro vs small molecular weight compounds) 2. Measurements of molecular weights and their distribution (fractionation, end groups, osmometry, light scattering, sedimentation, viscosimetry, gel permeation chromatography) 3. Measurements and devices to investigate mechanical and physical properties (thermoplastics, elastomers, thin foils, foams): compression, scission, elongation tests, hardness, abrasion, impact properties, density) 4. Characterization of polymer morphology (thermal, X-Ray, microscopic methods) 5. Devices and methods to investigate thermal properties of polymers (thermophysical stability, thermomechanical, flammability) 6. Others specific properties (biodegradability, sterilization). 7. Polymer processing methods (injection molding, extrusion, thermoforming, polymerization molding). 8. Selection of polymers for specific applications.						

Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture	60.0%	60.0%
	Laboratory	60.0%	40.0%
Recommended reading	Basic literature	1. Broniewski T., Kapko J., Płaczek W., Thomala J. T.: Metody badań charakterystyczne dla polimerów, WNT, W-wa 1970. 2. Łaczyński B.; Tworzywa wielkocząsteczkowe, WNT W-wa 19823.  2. Mark J.E., Physical Properties of Polymers Handbook, Springer New York 2007  3. Astarita G., Nicolais L., Polymer Processing and Properties, Springer Science & Business Media, 2012	
	Supplementary literature	1. Landel R.F, Nielsen L.E., Mechanical Properties of Polymers and Composites, Second Edition, CRC Press 1993  2. Standards (ASTM, DIN, ISO)	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<ol 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 <math>\sigma = f(\epsilon)</math> 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> </ol>		
Work placement	Not applicable		