



## Subject card

Subject name and code	Structure and properties of polymers, PG_00061930						
Field of study	Struktura i właściwości materiałów polimerowych						
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	5	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Polymer Technology -> Faculty of Chemistry -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Michał Strankowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60		5.0		60.0	125
Subject objectives	The aim of the course is to present students with issues related to the structure of polymers and its influence on the macroscopic properties of polymeric materials.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U02] Can operate typical laboratory equipment and analyze material tests	The student is proficient in operating equipment for plastics processing and analysis.			[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu		
	[K6_K01] Understands the need to improve professional and personal competencies; is conscious of own limitations and knows when to turn to experts, properly establishes priorities helping to accomplish tasks defined by oneself or others.	The student understands polymer science and can solve problems related to plastics			[SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce		
	[K6_W07] Has detailed knowledge of selected problems of materials science.	The student has skills related to the analysis of polymer materials.			[SW1] Ocena wiedzy faktograficznej		
[K6_U06] Can integrate obtained information, interpret it and draw conclusions, as well as formulate and justify opinions.	The student is able to skillfully interpret and draw conclusions about issues related to the structure of plastics.			[SU2] Ocena umiejętności analizy informacji			

Subject contents	<p><b>Lecture Topics</b></p> <ol style="list-style-type: none"> <li>1. Introduction to Polymers: Basic definitions, history, and classification.</li> <li>2. Polymerization Mechanisms and Kinetics: How are polymers made?</li> <li>3. Polymer Chain Structure: Conformation, configuration, and tacticity.</li> <li>4. Molecular Weight and its Distribution (Polydispersity).</li> <li>5. Physical States and Morphology of Polymers.</li> <li>6. Phase Transitions and Thermal Properties.</li> <li>7. Mechanical Properties.</li> <li>8. The Influence of Structure on Other Properties.</li> <li>9. Degradation and Stabilization of Polymers.</li> <li>10. Modern Trends: Blends, composites, and functional polymers.</li> </ol> <p><b>Laboratory</b></p> <p>Part I: Thermal Analysis</p> <ol style="list-style-type: none"> <li>1. Determination of the glass transition temperature (T<sub>g</sub>) by Differential Scanning Calorimetry (DSC).</li> <li>2. Analysis of melting (T<sub>m</sub>) and crystallization (T<sub>c</sub>) temperatures for semi-crystalline polymers.</li> <li>3. Investigation of the thermal stability of polymers using Thermogravimetric Analysis (TGA).</li> <li>4. Investigation of polymer behavior under the influence of temperature and frequency (DMA - Dynamic Mechanical Analysis).</li> </ol> <p>Part II: Mechanical Testing</p> <ol style="list-style-type: none"> <li>5. Static tensile test: Determination of Young's modulus, yield strength, and ultimate tensile strength.</li> <li>6. Measurement of polymer hardness using the Shore method.</li> <li>7. Impact strength testing using the Charpy method.</li> <li>8. The effect of temperature on mechanical properties: Testing at elevated temperatures (Zwick/Roell).</li> </ol> <p>Part III: Linking the Structure and Properties of Polymeric Materials</p> <ol style="list-style-type: none"> <li>9. The influence of the degree of crystallinity on mechanical properties (DSC + tensile testing machine).</li> <li>10. Identification of an unknown polymer based on comprehensive analysis (DSC + TGA + DMA).</li> </ol>											
Prerequisites and co-requisites	Basic knowledge of the production and processing of polymeric materials.											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 855 794 884">Subject passing criteria</th> <th data-bbox="799 855 1137 884">Passing threshold</th> <th data-bbox="1142 855 1481 884">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 891 794 920">Passing laboratory tests</td> <td data-bbox="799 891 1137 920">50.0%</td> <td data-bbox="1142 891 1481 920">50.0%</td> </tr> <tr> <td data-bbox="456 927 794 956">Passing lecture tests</td> <td data-bbox="799 927 1137 956">50.0%</td> <td data-bbox="1142 927 1481 956">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Passing laboratory tests	50.0%	50.0%	Passing lecture tests	50.0%	50.0%
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Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Explain the differences in the structure of the following polymers: LDPE, HDPE, and LLDPE.</li> <li>2. What topological structures can macromolecules form?</li> <li>3. Briefly characterize the structure and properties of polyurethane nanocomposites containing graphene derivatives.</li> <li>4. Describe the properties of a selected polymer as a function of its tacticity.</li> <li>5. Characterize the most important conformational shapes of a polymer chain.</li> <li>6. Describe the structure and properties of liquid crystal polymers.</li> </ol>											
Practical activities within the subject	Not applicable											

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