Andrzej **Gałęski**

Professor – CMMS PAS

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Currently held positions

Department of Polymer Nanomaterials, Centre of Molecular and Macromolecular Studies of the Polish Academy of Sciences *Łódź*

Professor

Scientific profile and collaborations

My scientific research focuses on the development of physico-chemistry, physics and technology of modern polymer materials, in particular this concerns phenomena occurring at the nano-scale and leading to the development of new polymer-based materials. Polymer materials are a special type of nano-materials in which the nano-structure, composed of lamellar crystals separated by interlamellar amorphous phase, forms in the crystallization process. The properties of such partially crystalline polymers are therefore determined by phenomena and interactions at the nano-scale, both in the amorphous nanolayers and lamellar crystals of nanometer thickness. Polymer-based nanomaterials also include nanocomposites in which nanoparticles are dispersed in polymer matrices, as well as dispersed polymer nanoparticles and nanolayers. Polymer systems containing nano-layers are model systems that allow both understanding of the occurring phenomena and control of the structure and properties. Studies of the nano-scale phenomena focused on the understanding and use of the plasticity mechanisms of semi-crystalline plastics. A significant part of them concerned the investigation of phenomena in novel polymer nano-composite materials, as well as in novel biodegradable polymer materials, with broad potential applications in medicine, agriculture and industry. Although polymers are considered as plastic materials, the phenomena determining their plasticity have not been sufficiently understood so far. In particular, this concerns the understanding of the role of crystal plasticity and cavitation processes in amorphous, nanolayer intercrystalline areas and its relationships with the so-called dynamic free volume of the amorphous phase. It is important to understand both the role of cavitation and the consequences of its elimination. Cavity free plastic deformation leads in particular to the possibility of obtaining high-strength polymer materials, comparable to or better than strong steel. Most efforts are devoted to the development of biodegradable and bio-based plastics.

Selected publications

2024 ***Exploring the potential of lignin nanoparticles in enhancing the mechanical, thermal, and bioactive properties of poly (butylene adipate-co-terephthalate)*** **[link]**

2009 ***Confined Crystallization of Polyethylene Oxide in Nanolayer Assemblies*** **[link]**

1987 ***Acoustic Emission During Crystallization of Polymers*** **[link]**

Research grants

Principal Investigator: 12 grants: KBN, NCN, European Commission

Current NCN grant: Foaming of polymer nanocomposites

Obtained patents

12 patents given by Polish Patent Office, European Patent Office and USA Patent Office

International research stays

USA, Ohio: Department of Macromolecular Science, Case Western Reserve University, Cleveland

USA, Massachusetts: Depts of Chemical and Mechanical Engineering, Massachusetts Institute of Technology, Cambridge

Italy: Institute of Technology and Rheology of Polymers, CNR, Arco Felice

France: Ecole Nationale Superiere d'Arts et Metiers, Paris