POLISH NATIONAL AGENCY FOR ACADEMIC EXCHANGE

STER PROGRAMME

name of the unit:		symbol:
DIVISION OF RUBBER ENGINEERING & TECHNOLOGY Institute of Polymer & Dye Technology, Lodz University of Technology		I-33 http://www.polimbarw.p.lodz.pl/.
head of the unit:	potential promoters:	contact person:
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scope of activities:

The main areas of interest and research directions are the following problems falling within the general concept of Engineering of Polymer Composites:

- Ceramizable polymers: synthesis, properties and application
- Plasma assisted modification of fillers: surface characterization, activity in polymers
- Surface engineering of polymer materials: modification (plasma, laser, ion beam) and characterization (ToF SIMS, AFM, nanoindentation), SFE/wettability and tribology
- Sulfur crosslinking systems: mechanisms and crosslinks structure
- Sulfur copolymers: synthesis and applications (sulfur concrete)
- Application of Ion Mobility Spectroscopy (artificial nose) in rubber technology, exploitation and product authentication
- Rubber nanocomposites containing GNP, CNT, Ag nanowires
- Valorization of bio-components, recycling products and wastes for rubber technology.

present activities:

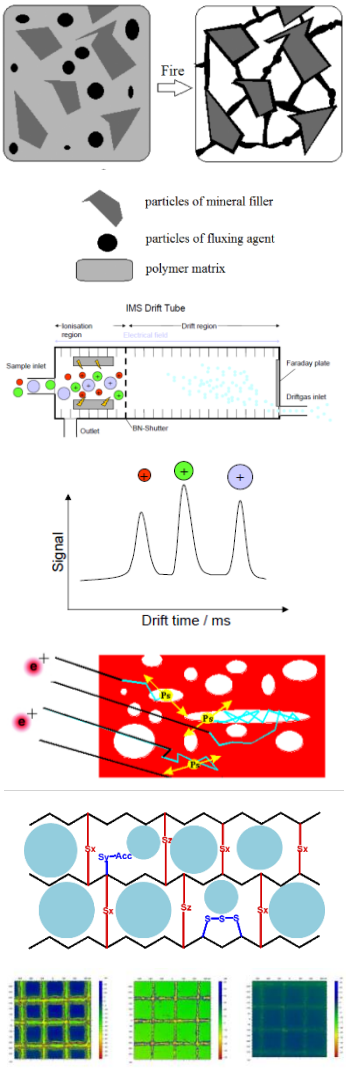
The investigations focused on the development of functional polymer composites for special applications. Synthesis or modification of polymers, fillers, curing agents and other components, deciding final properties of the whole system. The big research projects, funded by national or international institutions on:

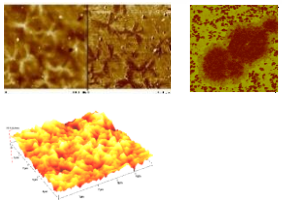
- Functional hybrid composites with designed properties (project pending)
- Ceramization concerning a new hybrid approach to fire protection of polymer materials (project pending)
- Development of a rubber compound expandable with supercritical CO_2 (project started)
- Self-healing and low glass transition temperature elastomers for Lunar applications (project to be submitted)

and cooperates with industrial partners on:

- The use of tribochemical phenomena in designing the composition of brake materials
- Application of Ion Mobility Spectroscopy (IMS) in rubber technology
- Valorization of fly ash from lignite combustion for rubber industry
- Intumescent fire protective paints
- Application of pyrolytic carbon black in tire manufacturing

graphic material



• Composite materials based on anionic bitumen emulsion with extended functionality • Modification of hybrid nail polishes in terms of their easier removal. The Division offers its expertise and unique research infrastructure enabling for solving interdisciplinary problems and analysis concerning engineering of elastomers, surface engineering and tribology. The Division supervises the Student Chapter affiliated with the Rubber Division of the American Chemical Society.	

Future activities:

Developing current research directions and involving new analytical techniques e.g. IMS, AFM or nanoindentation, in monitoring compounding, processing and exploitation of polymer materials.

Keywords:

polymer, elastomer, rubber, polymer composites and fillers: surface engineering and analysis, modification of properties, morphology, interphase interactions, aging and degradation, flammability and fire protection, adhesion

List of internship proposal in this research team:

- Modification of tribological properties of elastomers or elastomer composites
- Application of IMS (artificial nose) in authentication, processing and exploitation of polymer materials
- Surface modification of polymer materials

List of attachments:

Exemplary recent publications awards and projects.

Publications:

1. R. Anyszka, D.M. Bieliński, Z. Pędzich, M. Zarzecka-Napierała, M. Imiela, P. Rybiński, Processing and Properties of Fire Resistant EPDM Rubber-Based Ceramifiable Composites. HIGH TEMPERATURE MATERIALS & PROCESSES 2017, 36 (10), 963-969. 10.1515/htmp-2016-0059

2. K. Bandzierz, L. Reuvekamp, G. Przybytniak, D.M. Bieliński, Effect of electron beam irradiation on structure and properties of styrene-butadiene rubber. RADIATION PHYSICS & CHEMISTRY 2018, 149, 14-25. 10.1016/j.radphyschem.2017.12.011

3. K. Bandzierz, L. Reuvekamp, J. Dryzek, W. Dierkes, A. Blume, D.M. Bieliński, Effect of polymer chain modifications on elastomer properties. RUBBER CHEMISTRY & TECHNOLOGY 2019, 92 (1), rok 2019, 69-89. 10.5254/RCT.18.82685

4. J. Wręczycki, D.M. Bieliński, M. Kozanecki, P. Maczugowska, G, Mlostoń, Anionic Copolymerization of Styrene Sulfide with Elemental Sulfur (S8). MATERIALS 2020, 2597. 10.3390/ma13112597

5. R. Anyszka, K. Beton, M. Szczechowicz, D.M. Bieliński, A. Blume, Velcro-inspired supramolecular system for silica-rubber coupling. RUBBER CHEMISTRY & TECHNOLOGY 2020, 93 (4), 672-682. 10.5254/rct.20.79966

6. D. Pietrzak, D.M. Bieliński, D. Henneicke, Studies of conventional sulfur vulcanization of SBR rubber: Analysing the reaction products from thermal degradation of the accelerator by means of MCC-IMS technique. POLYMER TESTING 2020, 90, 106715. 10.1016/j.polymertesting.2020.106715

7. D.M. Bieliński, K. Klajn, T. Gozdek, R. Kruszyński, M. Świątkowski, Influence of n-ZnO Morphology on sulfur crosslinking and properties of Styrene-Butadiene Rubber vulcanizates. POLYMERS 2021, 13 (7), 1-15. 10.3390/polym13071040 8. M. Prochoń, D.M. Bieliński, P. Stepaniak, M. Makowicz, D. Pietrzak, O. Dzeikala, Use of ashes

from lignite combustion as fillers in rubber mixtures to reduce VOC emissions. MATERIALS 2021, 14 (17), 1-18. 10.3390/ma14174986

Awards:

Ceramizable polymer composites for special fire protection installations - Lodzkie Eureka 2015.

Projects:

1. OPUS 3/2012/05/B/ST8/02922: New generation of carbon fillers for preparation of modern polymer composites. 2013-2016
2. POIR.01.02.00-00-0022/16: Elaboration of production technology of ceramizable composites based on PVC. 2016-2018
3. GEKON 1/05/213122/26/2015: Development and preparation for implementation of a technology to produce sulphur concrete based on waste products from the energy and petrochemical industries. 2015-2017
4. POIR.04.01.04-00-0034/18-00: Functional hybrid composites with designed properties. 2018-2021
5. HORYZON 2020 “Building a low-carbon, climate resilient future: Research and innovation in support of the European Green Deal (H2020-LC-GD-2020)”: FRONTSH1P. 2020-2024