name of the unit:		symbol:
FUNCTIONAL POLYMERS; POLYFUN Institute of Polymer and Dye Technology, Faculty of Chemistry, Lodz University of Technology		I-33 http://www.polimbarw.p.lodz.pl
head of the unit:	potential promoters:	contact person:
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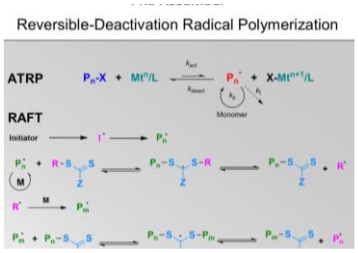
scope of activities:

Reversible-deactivation radical polymerization (RDRP) technique offers the possibility to control the molecular weight and the topology of polymer chains to obtain the designed materials. It has been two decades since the discovery of RDRP, which includes atom transfer radical polymerization (ATRP) and reversible addition–fragmentation chain-transfer polymerization (RAFT). They have become versatile tools for synthesis of a range of polymers, including poly(meth)acrylates, poly(meth)acrylamides, polystyrene and polyacrylonitrile. Also, those polymerization techniques have been successfully used for the modification of inorganic surfaces, particles, proteins to generate hybrids materials and bioconjugates with varied polymer composition and chains architecture.

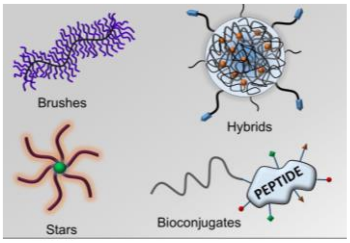
The scope of our activities deals not only with issues related to the classical chemistry of polymers, but also with the problems of material engineering in the context of the synthesis of functional materials and surface modification of various types of particles. As a tool for the synthesis of polymers, e.g., radical polymerization methods with reversible deactivation (RDRP) are used.

graphic material

Polymerization methods



Pre-assembled structures



Drug Delivery; Nanocomposites; Nanoreactors; Coatings; Electro-optical Devices

present activities:

The current projects are dedicated to the following scientific problems:

- to provide an antioxidative and electroactive wound dressing for severe skin injuries that actively supports the healing process and releases active proteins as last resort drugs against a set of major (multiresistant) bacterial and fungal pathogens with critical importance in hospital acquired infections.
- to deliver, within a single injection, multiple drugs into the joint cavity, to stimulate cartilage regeneration while stopping mechanical abrasion and inflammation.
- to design, synthesize and characterize of new copolymers with a molecular bottlebrush topology to be applied at various levels of advancement of the degenerative disease.
- to design polymer blend with specific rheological and stimuli responsive properties.
- to design and characterize elastomers with new carbon based fillers.

Future activities:

The future research activities are focused on the synthesis of functional polymer materials used for wound dressing, drug delivery, demonstrating lubricating properties, shape memory and stimuli responsive effect.

Keywords:

Reversible-deactivation radical polymerizations, functional polymers, star polymers, bottle-brushes, polymer brushes, block copolymers, polymer blends, carbon based fillers, polymer rheology, nanocomposites

List of internship proposal in this research team:

Synthesis of functional macromolecules with non-linear topology; Synthesis of stimuli-responsive polymer gels and interpenetrating networks; Surface modification of inorganic particles by polymers; Material engineering of novel "smart" polymeric materials
List of attachments: *Selected scientific publications:* • Galeziewska M.; Holos A.; Ilcikova M.; Mrlik M.; Osicka J.; Srnec P.; Micusik M.; Moucka R.; Cvek M.; Mosnacek J.; Pietrasik J. One-Pot Strategy for the Preparation of Electrically Conductive Composites Using Simultaneous Reduction and Grafting of Graphene Oxide via Atom Transfer Radical Polymerization, *Macromolecules* 2021, 54, 10177-10188. • Toczek K.; Lipińska M.; Pietrasik J. Smart TPE Materials Based on Recycled Rubber Shred, *Materials* 2021, 14, 6237. • Raj W.; Jerczynski K.; Rahimi M.; Przekora A.; Matyjaszewski K.; Pietrasik J. Molecular bottlebrush with pH-responsive cleavable bonds as a unimolecular vehicle for anticancer drug delivery, *Materials Science & Engineering C* 2021, 130, 112439. • Gaca M.; Ilcikova M.; Mrlik M.; Cvek M.; Vaulot C.; Urbanek P.; Pietrasik R.; Krupa I.; Pietrasik J. Impact of ionic liquids on the processing and photo-actuation behaviour of SBR composites containing graphene nanoplatelets" Sens. Actuat. B Chem. 2021, 129195. *Research projects:* NCN, OPUS, UMO-2018/29/B/ST5/02412, New Bottle-Brush copolymers, and osteoarthritis. NCN, OPUS-LAP, UMO-2020/39/I/ST5/02108, Antimicrobial, antioxidative and electroactive ultrathin polymeric films for advanced skin wound dressings. NCBR, EuroNanoMed, Cartilage Protection and Regeneration Consortium.