

Séminaire Minisymposium on Block Copolymers



Mardi 28 février 2023 à 10h00
Amphithéâtre Henri Benoît et visio

Microphase separation in statistical multiblock copolymers

Elena N. Govorun, ESPCI Paris

Design of polymer sequences is a tool to control macromolecular self-assembly for biopolymers and synthetic polymers. More and more methods for the synthesis of statistical multiblock copolymers emerge and such copolymers are promising for applications in different areas. At the same time, they are not easy to explore and to establish structure-properties relations. In the talk, the peculiarities of microphase separation are described theoretically for the particular copolymer type with short and long blocks in the case of strongly segregated long blocks and for the close-to-alternating copolymers composed of macromonomers. Besides, the statistics of polymer chains with monomer unit sequences obtained via the spatial patterns of lamellae, hexagonally packed cylinders, and balls in a body-centered cubic lattice is studied. Some results are considered in relation to the computer simulations by dissipative particle dynamics.

Design of multiblock copolymers with unsaturated main chains

Yaroslav V. Kudryavtsev, ESPCI Paris

Multiblock copolymers attract considerable interest due to their ability to combine the properties of individual components, to self-assemble into various morphologies, and to demonstrate better thermal and mechanical characteristics relative to corresponding homopolymers and their blends. In this talk, I will discuss our efforts in developing a method for the synthesis of statistical multiblock copolymers based on the interchain olefin cross-metathesis reaction of polymers containing double bonds in their backbones [4]. Its attractiveness lies in the possibility to use commercial unsaturated polymers (polyalkenamers, polynorbornenes, polydienes, etc.) and metathesis catalysts and to introduce various functional groups (acetoxy-, carboxy-, hydroxy-, epoxy-, trimethylsilyl-, and fluorine) into the copolymers through the use of substituted monomers in the synthesis of initial homopolymers or by post-modification of the cross-metathesis products [5,6]. The in situ and ex situ NMR studies allow us to monitor the process of copolymer formation and evolution of its degree of blockiness. The analysis of this information in terms of kinetic models provides a powerful tool to design the multiblock copolymers with desired functional properties.

[References and CV on the back]

Les personnes souhaitant rencontrer Elena Govorun ou Yaroslav Kudryavtsev sont priées de prendre contact avec Hendrik Meyer ou Albert Johner.

1. Govorun E.N., Chertovich A.V. *J. Chem. Phys.* 2017, **146**, 034903.
2. Rudyak V.Yu., Larin D.E., Govorun E.N. *Macromolecules* 2022, **55**, 9345.
3. Govorun E.N., Shupanov R.M., Pavlenko S.A., Khokhlov A.R. *J. Phys. A: Math. Theor.* 2021, **54**, 235004.

Elena N Govorun has obtained her Ph.D. in physics from the Lomonosov Moscow State University and worked there as an Associate Professor at the Faculty of Physics, Chair of Polymer and Crystal Physics. Her research interests are in the field of statistical theory of macromolecular systems including the self-assembly phenomena in the complex systems. In particular, she collaborates with the groups performing computer simulations. This year Elena stays at Gulliver lab of ESPCI Paris within the Pause program.

[4] M.L. Gringolts et al. Olefin metathesis in multiblock copolymer synthesis. *Beilstein J. Org. Chem.* 15 (2019) 218-235

[5] Yu. I. Denisova et al. Facile synthesis of norbornene-ethylene-vinyl acetate/vinyl alcohol multiblock copolymers by the olefin cross-metathesis of polynorbornene with poly(5-acetoxy-1-octenylene). *Polym. Chem.* 11 (2020) 7063-7077

[6] Yu.I. Denisova et al. Olefin cross-metathesis of polynorbornene with polypentenamer: New norbornene-cyclopentene multiblock copolymers. *Eur. Polym. J.* 173 (2022) 111264

Yaroslav Kudryavtsev has obtained his Ph.D. in physics from the Lomonosov Moscow State University and passed Habilitation at the Semenov Institute of Chemical Physics of the Russian Academy of Sciences. His work at the Topchiev Institute of Petrochemical Synthesis is focused on studying macromolecular reactions and copolymer ability to self-assemble in various media. He also serves as an Editor for the *Polymer Science* journal. This year he stays at the Gulliver lab of ESPCI Paris within the Pause program.