



The Chinese University of Hong Kong
Department of Chemistry
Research Seminar Series

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Title: Immiscibility-driven Folding of Synthetic Polymers – Accessing sub-10 nm scale microphase separation

<< Abstract >>

Segmented polymers of different types carrying two or more immiscible segments tend to self-segregate leading to the emergence of several interesting properties, such as in thermoplastic elastomeric polyurethanes, liquid crystalline polymers, nanostructured polymeric films, etc. Such segmented polymers can be of several types, such as block copolymers (di-, tri- and multi-) and graft copolymers, in addition to other topological variations of these, such as star-block copolymers. When the length of the segments and the periodicity of their placement are precisely controlled, well-defined and predictable morphologies are seen; however, when both these features are not very precisely defined then randomly phase-separated systems emerge, which, despite the randomness, can yield remarkably useful properties, such as in the case of thermoplastic polyurethanes.

Periodically grafted copolymers is an interesting class of systems, wherein the immiscibility between the backbone segment that lies between the graft locations and the grafted chains could drive a zigzag folding of the polymer chain to facilitate the collocation of the two immiscible segments; crystallization of either one or both the segments could further reinforce the folded chains. I shall discuss two types of systems wherein self-segregation followed by crystallization leads to the stabilization of a specific reconfigured conformation and further leads to the formation of well-defined morphology in the solid state: in one case, by designing suitable periodically grafted amphiphilic graft copolymers, while in the other by generating *Janus*-type amphiphilic hyperbranched structures. The central theme in both these systems is the exploitation of the strong tendency for long alkylene segments to crystallize in a paraffinic-type crystalline lattice. I shall discuss these new designs to control the conformation at a single-chain level, provide evidences for their formation and discuss the consequences of such molecular-level control on their bulk morphology.

References

1. Ashok Zachariah Samuel and S. Ramakrishnan, “Janus Hybramers: Self-Adapting Amphiphilic Hyperbranched Polymers” *Macromolecules* 45, 2348 (2012)
2. Raj Kumar Roy, E. Bhoje Gowd and S. Ramakrishnan, “Periodically Grafted Amphiphilic Copolymers: Nonionic Analogues of Ionenes” *Macromolecules* 45, 3063 (2012)
3. Joydeb Mandal, S. Krishna Prasad, D. S. Shankar Rao and S. Ramakrishnan, “Periodically clickable polyesters: Study of intra-chain self-segregation induced folding, crystallization and mesophase formation” *J. Am. Chem. Soc.* 136, 2538 (2014)
4. Sananda Chanda and S. Ramakrishnan, “Controlling Interlamellar Spacing in Periodically Grafted Amphiphilic Copolymers” *Macromolecules*, 49, 3254 (2016)

Date: April 11, 2019 (Thursday)

Time: 2:30 p.m.

Venue: Room C5, Lady Shaw Building

