“Living” Crystallization-Driven, Seeded Growth Approaches to Functional Supramolecular Materials

Although chemical synthesis has evolved to a relatively advanced state, the ability to prepare uniform samples of polymer-based “soft” materials of controlled shape, size, and structural hierarchy on a length scale from 10 nm – 100 microns is still in its relative infancy and currently remains the virtually exclusive domain of biology. In this talk a promising new route to well-defined 1D and 2D materials within this size regime, termed “living crystallization-driven living self-assembly” (CDSA), will be described. The “seeded growth” characteristic of living CDSA means that the process can be regarded as a type of “living supramolecular polymerization” that is analogous to living covalent (e.g. anionic) polymerizations of molecular monomers and also to biological “nucleation-elongation” processes such as amyloid fiber growth. Living CDSA was discovered as a result of an investigation of the solution self-assembly behavior of block copolymers with crystallizable polyferrocenylsilane (PFS) metalloblocks but has now been extended to an array of block copolymers with crystallisable organic blocks, including pi-conjugated or biodegradable materials, and also to molecular amphiphiles that form pi-stacked or hydrogen-bonded supramolecular polymeric assemblies. Potential applications exist in a diverse range of areas from nanoelectronics to delivery vehicles and these will be discussed.

Selected Recent References: *Nature Chem.* **2014**, 6, 8934: *Science* **2015,** *347*, 1329. *Science* **2016**, *352*, 697: *Nature Chem.*, **2017**, *9*, 785: *Nature Mat.*, **2017**, *16*, 481; *Nature Commun.*, **2017**, *8*, 15909; *Nature Commun.* **2017**, *8*: 426.

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