Polymerisation-Induced Self-Assembly

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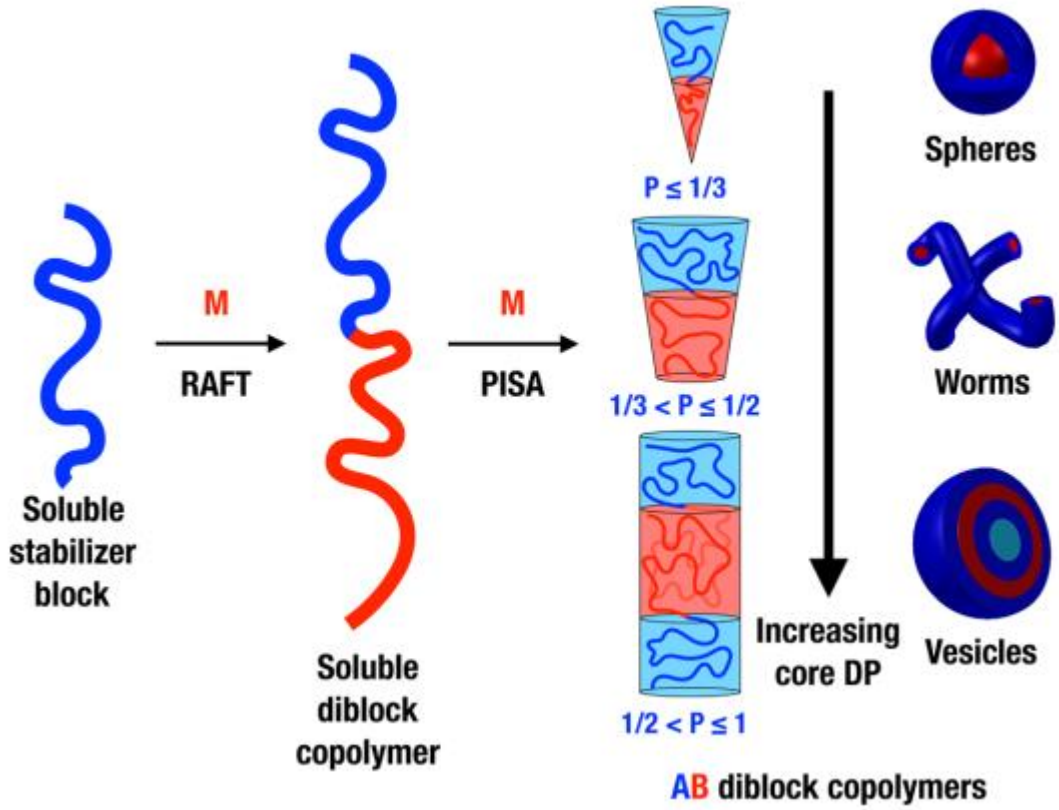
Polymerisation-induced self-assembly (PISA) is a powerful and versatile technique for the rational synthesis of concentrated dispersions of block copolymer nano-objects of controllable size, shape and surface chemistry (see **Figure 1**). In essence, an insoluble block is grown from one end of a soluble block in a suitable solvent. Once the growing block reaches a certain critical degree of polymerisation, micellar nucleation occurs and the soluble block then acts as a steric stabiliser. Unreacted monomer diffuses into the copolymer cores, which leads to a relatively high local concentration and hence a significant rate acceleration. Depending on the target diblock copolymer composition, the final copolymer morphology can be spheres, worms or vesicles. The design rules for PISA are generic: such syntheses may be conducted in water, polar solvents or non-polar solvents using reversible addition-fragmentation chain transfer (RAFT) polymerisation. Over the past decade, PISA has become established as a highly versatile platform technology for the rational design of bespoke polymer colloids. Various examples of PISA formulations and their potential applications will be discussed in this lecture.

Figure 1. Schematic representation of polymerisation-induced self-assembly (PISA). Systematic variation of the length of the insoluble red block enables the efficient rational synthesis of spheres, worms or vesicles as concentrated colloidal dispersions in either polar or non-polar media.



Biography

Prof. Steve Armes graduated from the University of Bristol (BSc 1983, PhD 1987). He worked as a postdoctoral fellow at Los Alamos National Laboratory for two years (1987-1989) and then accepted a lectureship at Sussex University. He was promoted to Professor in 2000 and moved to U. Sheffield in 2004. He was elected as a Fellow of the Royal Society in 2014.

Steve has published 727 papers (H-index 128; > 50,000 citations). His research interests include polymerisation-induced self-assembly, water-soluble polymers, block copolymer self-assembly, Pickering (nano)emulsions, gels, foams, colloidal nanocomposite particles, polymer brushes, and designing synthetic mimics for cosmic dust particles.

He has received numerous awards and prizes, including six RSC medals, a Royal Society medal, an SCI Innovation in Formulation award, the 2016 DSM Materials Science prize, the ECIS-Solvay 2017 prize, and the 2024 JCIS Darsh Wasan award.