

## **The nano-scale structure of polymer amphiphilic systems: tailored new phases and applications as smart materials**

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The phase behaviour of diblock block copolymer systems and simple amphiphiles are by now rather well understood both theoretically and experimentally, including the nanoscale ordered phases: lamellar, body centred cubic structure of spherical micellar, hexagonal packed cylinders, and the more complex gyroid and modulated lamellar phases near the boundaries [1]. Using external fields it is possible to control the morphology further [2]. Going beyond simple linear diblock copolymers gives potential for a large variety of new phases. Examples are star-shaped molecules consisting of more than 2 mutually immiscible polymer blocks. As a consequence of the star-shaped geometry, such polyphiles self-assemble along one-dimensional lines, and not along surfaces as in the case of linear block copolymers [3]. A wealth of possible novel nanostructures are predicted. We will review some recent results on both linear and star shaped polymer block copolymer systems, and discuss their stability versus mechanical treatment and chemical additives [4,5,6]. We will further discuss the potential use of block copolymers as templates for smart membrane materials [7].

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