Polymeric Coatings for Colloidal Particles: Modifying Form and Function

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The use of polymeric coatings to produce functional materials and modify material properties is an area of increasing interest. We are particularly interested in producing thin-films of controllable architecture, which are in some way stimulus-responsive. In doing so, we aim to manufacture structured coatings with tuneable behaviour. The use of water-soluble diblock copolymers offers an attractive route, due to their ability to form aggregates of variable morphology in solution, which may then be transferred to a solid surface. Diblocks based on tertiary amine methacrylates have been used to produce thin-films of adsorbed cationic micelles at mica and silica surfaces. Atomic force microscope (AFM) images show that the inter-micelle spacing in the film is readily altered, from close-packed to random, by subtle changes in the diblock chemistry. Additionally, such thin-films respond to changes in solution pH, varying from micellar at high pH to an extended brush at low pH, and back again. We have used quartz crystal microbalance (QCM-D) to probe the reversible nature of these films, and to assess their potential as capture/release devices. These copolymer micelles have also been used, in conjunction with anionic copolymer micelles, to produce micellar multilayers on silica flats and particles. The development of these multilayers, and their potential application, has been studied using a suite of techniques including AFM, QCM-D, dynamic light scattering, zeta and streaming potential, and UV-Vis and fluorescence spectroscopy. Finally, we have been investigating the fabrication of pH-responsive polyelectrolyte brush layers on silica particles using aqueous ATRP, with an interest in using such coated particles as, for example, rheology modifiers.