Stimuli-responsive Novel Amphiphilic Polymers for Chemical and Biomedical Applications

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***Abstract* – Amphiphilic polymers are a class of polymers that self-assemble into different types of microstructure, depending on the solvent environment and external stimuli. Self assembly structures can exist in many different forms, such as spherical micelles, rod-like micelles, bi-layers, vesicles, bi-continuous structure etc. Most biological systems are basically comprised of many of these organised structures arranged in an intelligent manner, which impart functions and life to the system. We have adopted the atom transfer radical polymerization (ATRP) technique to synthesize various types of block copolymer systems that self-assemble into different microstructure when subject to an external stimuli, such as pH or temperature. The systems that we have studied are: (1) pH responsive fullerene (C60) containing poly(methacrylic acid) (PMAA-b-C60); (2) pH and temperature responsive fullerene containing poly[2-(dimethylamino)ethyl methacrylate] (C_{60}-*b*-PDMAEMA); (3) other responsive water-soluble fullerene systems. By varying temperature, pH and salt concentration, different types microstructure can be produced. In the presence of inorganic salts, fractal patterns at nano- to microscopic dimension were observed for negatively charged PMAA-b-C60, while such structure was not observed for positively charged PDMAEMA-b-C60. We demonstrated that negatively charged fullerene containing polymeric systems can serve as excellent nano-templates for the controlled growth of inorganic crystals at the nano- to micrometer length scale and the possible mechanism was proposed. The physical properties and the characteristics of their self-assembly properties will be discussed, and their implications to chemical and biomedical applications will be highlighted.**