580f In Situ Monitoring of Phase Transition of a Temperature and pH Responsive Copolymer

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Polymers capable of undergoing a conformational coil-to-globule phase transition upon application of a stimulus, such as change of temperature or pH, show a great promise in a variety of biomedical applications. Polymers that exhibit the lower critical solution temperature behavior are promising components of drug and gene delivery systems and as molecular switches of protein activity. This paper describes temperature- and pH-dependent phase transition and association behavior of a copolymer of N-isopropylacrylamide with 1-vinylimidazole and polyethylene glycol as monitored in situ by AFM and light scattering. In situ AFM imaging is conducted in an AFM fluid cell equipped with a temperature control unit in the Liquid Tapping Mode. The copolymer film undergoes a sudden morphological change upon reaching the phase transition temperature. The coil-to-globule phase transition in the adsorbed polymer film is completely reversible with temperature. The phase transition temperature is however dependent on the film thickness. Light scattering shows that the phase transition temperature of the copolymer increases with increasing 1-vinylimidazole content and with decreasing pH. The study suggests that this class of copolymers is suitable for the design of biomedical devices capable of responding to small changes in pH.