

A Study of Temperature-triggered Laponite-poly(NIPAM) Dispersions: From Comb Copolymers to Fluid-to-Gel Transitions

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Temperature-responsive polymers are of considerable interest in the literature. In previous work from the group, poly(N-isopropylacrylamide) (PNIPAM) was grafted from electrodeposited laponite particles using surface-initiated atom transfer radical polymerisation (ATRP) using a simple quaternary amine cationic 2-bromoisobutyrate as initiator. The cationic initiator was adsorbed onto the laponite surface[1] due to the strong affinity of Laponite for quaternary amines. In this work a new family of quaternary amine cationic macroinitiators with quaternary amine groups as the side chains were synthesized by ATRP[2]. The macroinitiator was used for polymerization of NIPAM by aqueous ATRP to give a cationic PNIPAM comb polymer. The copolymers consisted of cationic macroinitiator as the backbone and PNIPAM as the side chains.

Oil-in-water (O/W) emulsions exhibiting reversible thermally induced gelation have been prepared using a graft (comb) copolymer containing PNIPAM as the backbone and poly(ethylene glycol) methacrylate as the side chains in our group [3]. In the present, two methods were used to prepare the laponite-poly(NIPAM) composites also exhibiting reversible thermally fluid-to-gel transitions. In the first cationic PNIPAM comb polymers were adsorbed onto the surface of dispersed laponite in water. These laponite-poly(NIPAM) dispersions flow at low temperature ($T < LCST$) and form strong gels at high temperature ($T > LCST$). The fluid-to-gel transition is reversible. Interestingly, the opposite effect is observed when laponite-poly(NIPAM) dispersions are prepared using surface-initiated ATRP of NIPAM in which quaternary amine macroinitiator is pre-adsorbed onto the laponite surface. At low temperature ($T < LCST$) these dispersions form gels whilst they exhibit flow at high temperature ($T > LCST$). Reasons for these differences are discussed.

References

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