Reversible Phase Transition of Polymer Brushes Prepared from Dual-Head Initiator ATRP Grafting Poly(N-isopropylacrylamide) on Silicate Platelets

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Abstract

A new class of organic-inorganic hybrid that exhibits reversible phase transformation properties under thermal treatment was generated. Thermoresponsive poly(N-isopropylacrylamide) (PNiPAAm) covalently tethered to nanosilicate platelets (NSP) with different bromo densities were prepared and the length and molecular weight distribution of PNiPAAm was precisely controlled. Two distinctive second-order transitions were observed during differential scanning calorimetry (DSC) analysis, indicating the existence of dual-segment density zones. The hybrid also underwent a phase transformation after thermal treatment with several heating and cooling cycles. After the thermal treatments, high graft density NSP-PNiPAAm was self-assembling and irreversible in third treatment, however, the NSP-PNiPAAm with four-times lower graft density was self-assembling in second treatment and reversible in seventh. The results showed the tether of PNiPAAm onto NSP greatly decreased the chain mobility, inhibited chain relaxation movements and hindered reversible coil-globule transitions. The temperature-controllable phase transition with different formation of an ordered domain has potential for the fabrication of new smart nanomaterials.

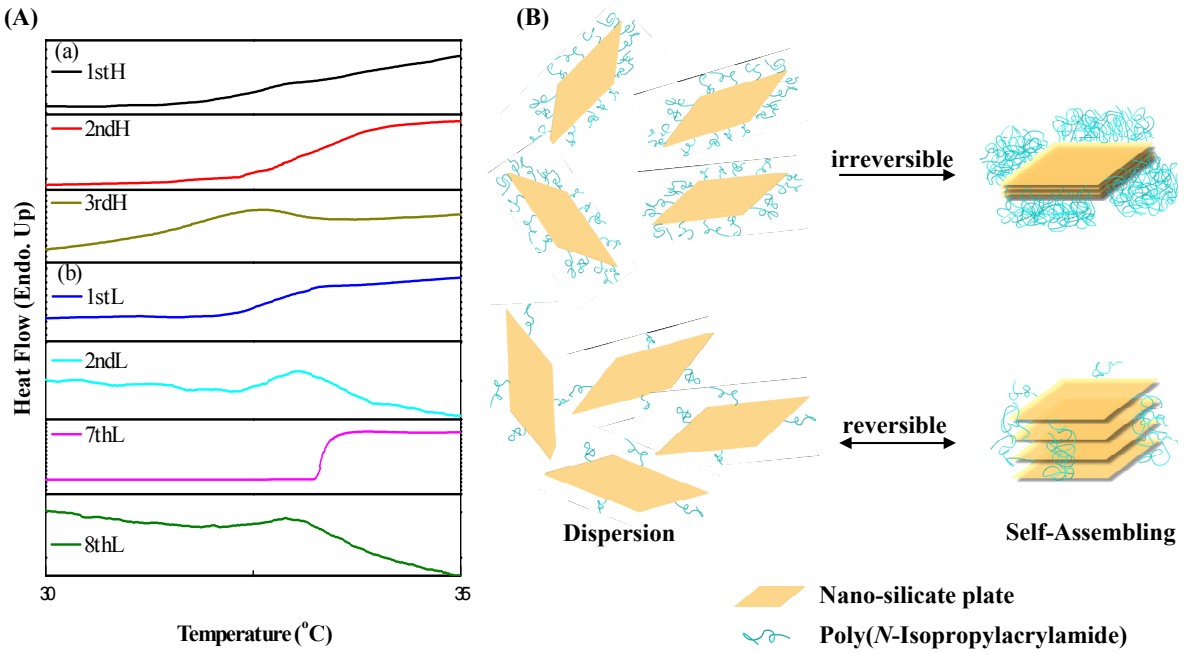

Figure 1. (A) DSC thermograms showing irreversible and reversible phase transition during the several heating process for NSP-PNiPAAm with (a) high graft density (b) lower. (B) Conceptual diagram of NSP-PNiPAAm irreversible and reversible phase transition.