

Confinement Effects on Polymer Structure and Dynamics: The Case of Polymer Nanocomposites[#]

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The behavior of polymers restricted in space or close to surfaces/interfaces can be very different from that in the bulk. In this work, we investigate the morphology and thermal properties of hydrophilic polymers in nanohybrids containing either layered silicates or silica nanoparticles. Mixing polymers with layered silicates can lead to intercalated hybrids when the interactions between the constituents are appropriate; these can serve as model systems for the investigation of the static and dynamic properties of macromolecules in nano-confinement. On the other hand, using silica particles of largely different sizes is an attempt to bridge the case of polymers confined within the galleries of layered silicates with that of polymer / single nanoparticle nanocomposites. Confinement is shown to modify the polymer structure, e.g., its crystallinity, with the effect being qualitatively different for different types of confinement. The dynamics of the confined polymers is probed by quasi-elastic neutron scattering and dielectric spectroscopy. The very local dynamics of the confined chains show similarities with those in bulk, whereas the segmental dynamics depend very strongly on the polymer/inorganic interactions varying from much faster to much slower or even frozen dynamics as the strength of the interactions increases.

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