Structure and Dynamics in Polymer Nanocomposites

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Abstract

Polymer materials are often filled with inorganics to improve their properties. The cases in which the additive exist in the form of a fine nm-sized dispersion within the polymeric matrix, thus producing a *nanocomposite*, allow the investigation of basic scientific problems. At the same time, these materials are utilized in a variety of applications.

We have investigated the control of the structure in polymer-inorganic nanocomposites by understanding and/or altering the interactions between the chains and the surfaces. Further than the dispersion and the structure of the inorganic material within the nanohybrid, the polymer structure, morphology, crystallinity and chain conformation in the presence of the inorganic material and/or in the proximity of the surfaces is of equal importance. Different additives of varying size and geometry, as well as different compositions have been utilized to probe the effect of the interactions and of the confining length.

Moreover, polymer dynamics close to surfaces or when chains are restricted in space can be very different from that in the bulk. We have investigated different polymer relaxation processes from the very local methyl rotation or the dielectrically active β and γ relaxations, to the phenyl flip and up to the segmental motion in the bulk and in the close proximity of an inorganic surface or under severe confinement. Polymers with different hydrophillicity, functional groups and / or different architectures as well as different inorganic additives have been utilized to investigate the influence of the interactions between the constituents and the geometry and size of the additive on the dynamics.