Polymers under Multiple Constraints

Kolloquium

Thursday,

18th October 2012

at: **5.15 pm**

Gustav-Mie-Hörsaal, Theodor-Lieser-Str. 9, 06120 Halle

Coffee will be served from 4.45 pm!

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Interfacial dynamics of polymer chains in nanocomposite hydrogels: An intermediate state towards solid-state nanocomposites

It is now well established that the incorporation of inorganic nanoparticles within bulk polymer chains may induce, under given conditions, a significant enhancement of its Young modulus. One of the key features involved in such a reinforcement stands in the specific local order and dynamics displayed by the polymer chains at the filler interfaces. While many investigations were carried out, until now, to get a better understanding of these interfacial phenomena, much less attention was paid to the formation pathway of such solid-state nanocomposites, when obtained, for instance, from a dispersion of polymer chains and colloidal particles in a common solvent. More specifically, the evolution of the local organization and dynamics of the interfacial polymer chains during solvent evaporation is an important question to be addressed: how do the local ordering effects of the polymer chains in the vicinity of the filler surfaces, occurring when adding colloidal particles into polymer solutions, vary as the solvent concentration is reduced?
Along this view, we considered model nanocomposites consisting in poly(ethylene glycol) (PEG) and Laponite, a synthetic clay composed of disk-shaped platelets. The solvent removal from an aqueous solution of PEG and Laponite, which finally leads to solid-state nanocomposites, first leads to the formation of an intermediate hydrogel structure. In this presentation, solution-state NMR will be used to probe the evolution of the PEG chain organization during the hydrogel formation. In particular, the level of local constraints undergone by the PEG chains will be monitored and this description at the molecular length scale will be correlated to the variation of the rheological behavior related to the gelation phenomena. In a second step, the dynamical behavior (segmental dynamics) of the interfacial PEG chains within the hydrogels will be investigated through ^{1}H, ^{2}H and ^{13}C solid-state NMR spectroscopy. In particular, the question of the characteristic motional frequencies as well as the motional geometry of such PEG chains will be discussed.