Polymers under Multiple Constraints

Kolloquium

Thursday,

18th July 2013

at: **5.15 pm**

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

Coffee will be served from 4.45 pm!

Prof. Dr. Stephan Förster

Institut für Physikalische Chemie, Universität Bayreuth

The perfect mix: making nanoparticles that like polymers

Polymer nanocomposites have gathered substantial academic and industrial interest since the first reports in the early 1990s. Observations of large property changes at very low volume fractions of added nanoparticles, and the possibility to integrate nanoparticles with specific properties providing new functions have motivated an increasing number of investigations. Further progress in nanocomposites is crucially limited by the strong tendency of nanoparticles to aggregate in polymeric matrices, a complication that also prevents a clear identification of the underlying nanoscale mechanism that leads to the striking efficiency of nanocomposites. We discovered a versatile route to fully miscible nanocomposites by coating nanoparticles with a brush-like polymer layer. We demonstrate the generality of this approach with the preparation of fully miscible metal, semiconductor and magnetic nanoparticles in amorphous and semicrystalline polymers, including polystyrene, polyisoprene, polyethylene oxide, polyethylene, and P3HT. In miscible nanocomposites nanoparticles assemble into superlattices with unprecedented order, which allows excellent control of the interparticle distance in polymeric matrices relevant for applications in magnetic and photovoltaic devices. In addition fully miscible nanocomposites are optically transparent at high loading ratios and enable for the first time to identify the relevant nanoscale mechanism that improves the efficiency of nanocomposites, revealing important parallels to the behavior of colloidal solutions.