

Soft Matter and Life Sciences: Research with Neutrons

Dieter Richter

Jülich Centre for Neutron Science; Forschungszentrum Jülich; 52425 Jülich; Germany

Research in soft matter deals with the integration of disciplines and subjects such as colloids, polymers or amphiphilic molecules including living and synthetic matter. In this field a joint approach of disciplines like physics, chemistry, biology and simulation science is essential, in order to arrive at novel insights. Challenges are e.g. the understanding (i) of selfassembly as the basic structuring mechanism in soft materials, (ii) of slow and often hierarchical dynamics in complex environments, (iii) of out of equilibrium systems and (iv) the establishment of a bridge to biology. A molecular understanding of the associated phenomena requires knowledge on the molecular structure and dynamics, that is revealed uniquely by scattering techniques in particular by the space time resolving neutron probe.

In my lecture I will go through results addressing key challenges in the field. I will discuss the efficiency boosting effect by amphiphilic blockcopolymers in selfassembling microemulsions. Fundamental aspects of chain dynamics in dense systems will be discussed on ring polymers. The dynamics of polymers in nanocomposites will serve as an example for the slow dynamics in complex environments including the issue of interphase formation and finally I discuss direct measurements on the space and time evolution of the interdomain motions in proteins that are important in promoting biochemical function.