Diffusion of spherical colloids through isotropic- and nematic-rod networks: 
**Screened hydrodynamics**

Depending on the ratio of the tracer-particle diameter and the mesh-size of an “entangled” rod-network, either direct interactions or hydrodynamic interactions are important. The long-time self diffusion coefficients of various sizes of spheres are measured by means of video microscopy (VM), dynamic light scattering (DLS), and fluorescence correlation spectroscopy (FCS). The figure below shows the fd-rod concentration dependence of the diffusion coefficient for various tracer sizes.

For spheres that are large compared to the mesh size of the network, diffusion is accompanied by strong deformation of the rod-network structure. For small spheres, the network structure is not affected. In that case, diffusion is essentially determined through hydrodynamic interactions of the tracer sphere with the rods. For crowded rod suspensions, the rods are entangled so that hydrodynamic interactions are screened. The effect of screening is characterized by the hydrodynamic screening length.

The relative importance of direct- and hydrodynamic-interactions is tuned by electrostatic interactions. A systematic study has been done, where the rod concentration and the ionic strength is varied systematically (both for isotropic and nematic networks). A theory has been developed that enables the calculation of the hydrodynamic screening length from measured diffusion coefficients. The hydrodynamic screening length is a very sensitive function of the degree of alignment of nematic rod networks.