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Short time diffusive properties in polydisperse solutions

Tuesday, 21 March 2023 16:00 (2 hours)

In biological environments, proteins are exposed to polydisperse surrounding. The interaction of this environment is essential for a correct function of the cell and disfunctions may lead to diseases. To understand the diffusive properties of proteins in polydisperse environments, we performed several quasi-elastic neutron scattering (QENS) experiments. Changes in the probed short-time self-diffusion are important to understand, since they influence the long time diffusion, which is essential e.g. for transport mechanisms. By using different proteins in the presence of deuterated lysate, we systematically investigated the influence of volume fraction, tracer size as well as mixing ratio on the protein diffusive properties in a polydisperse surrounding. The previously investigated volume fraction dependence is not valid anymore but an additional influence of the radius is observed. While large particles are slowed down compared to a monodisperse solution with the same volume fraction, smaller proteins are accelerated. In case the protein radius is comparable with the averaged radius, no significant effects of the polydispersity on the diffusion are observed [1].

A further quantitative understanding on the polydispersity has been obtained from QENS spectra of solutions containing two proteins. With advanced analysis methods, the different diffusive contributions can be separated [2].

[1] J. Phys. Chem. Lett. 10 (2019) 1709
[2] J. Phys. Chem. B 126 (2022) 7400

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