Exploring effects accompanying linear temperature-ramp in multispeckle DLS

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Multispeckle dynamic light scattering technique (multispeckle DLS) was used to study dynamics in concentrated sodium oleate/1-octanol/water vesicle gels and in poly(N-isopropylacrylamide) microgel systems during the linear temperature-ramp of various speeds. In the multispeckle DLS experiment a CCD camera is used to take images of the speckle pattern at a specific scattering vector in a constant time intervals. Data analysis according to the multispeckle correlation-scheme [1] yields the corresponding intensity autocorrelation function \(G_2(\tau)\), but even more importantly also the intermediate result, i.e. the so-called \(c_I(t, \tau)\) traces. Individual \(c_I(t, \tau)\) trace is a function of time that for a specific lag time \(\tau\) time-averages into a point of the intensity autocorrelation function: \(\langle c_I(t, \tau) \rangle_t = G_2(\tau)\). These traces give an important time-resolved insight into the dynamics of the system and as such enable to study the time-dependence of the dynamics at a certain length- and time-scale [1]. In this study three important effects blurring the multispeckle DLS results during the linear temperature-ramp were addressed: the loss of correlation due to the temperature induced shift of the scattering vector arising from the temperature dependence of the refractive index [1,2], due to the temperature induced shift in the position of the primary beam/scattering volume and due to the change in the scattering power/nature of the sample. Approaches for the corrections of the raw multispeckle DLS results due to these artefacts were proposed.

Correction of the correlation function of vesicle-gel system obtained by multispeckle DLS due to the movement of the primary beam caused by the linear temperature-ramp of speed 0.71 °C/h.