Experimental report

28/03/2017

Proposal: TEST-2591 **Council:** 4/2016

Title: Dynamics of Polyelectrolyte-microemulsion Mixtures

Research area:

This proposal is a new proposal

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Samples: D2O
C16H35NO
C17H38NBr
(C2H2O2)n
C10H22

Instrument	Requested days	Allocated days	From	To
IN15	3	3	13/09/2016	17/09/2016

Abstract:

Experimental Report for TEST-2591: Dynamics of Polyelectrolyte-microemulsion Mixtures

March 27, 2017

We measured the dynamics of mixtures of different slightly cationic o/w microemulsion (ME) droplets and anionic polyelectrolytes (polyacrylic acid (PAA) of different chain lenghts and hyaluronic acid (HA)) on the neutron spin-echo (NSE) spectrometer IN15 using wavelengths λ between 6 and 14 Å reaching Fourier times of up to 600 ns. The size of the ME droplets and the ratio between PE and droplets was varied.

Fitting the data with a simple exponential of the form $S(q,t) = \exp(-D_{eff}q^2t)$ it can be seen that the mixtures of microemulsions and polyelectrolyte are significantly slower than the pure ME (see fig. 1, purple squares: ME droplets without PE). This means that the microemulsion droplets are bound in relatively large mixed aggregates with the polyelectrolyte. At high q around 0.1 1/Å a peak in D_{eff} can be seen which is hardly affected by the addition of the different PEs. This peak is due to shape fluctuations of the ME droplets as described in the Milner-Safran model and it can be concluded that these shape fluctuations and the corresponding bending elasticity constants are not greatly influenced by the PEs. At lower q between 0.03 and 0.04 1/Å a small shallow peak is observed, which we currently believe to be due to a bending motion of elongated mixed aggregates. Their deformation in the radial direction of the aggregates are the same as in the droplet microemulsion and the deformation of the long axis would occur as a new dynamic mode. It can also be seen that the low q peak is slightly shifted to lower q for HA (green and blue triangles) compared to PAA (red circles). This will be investigated in more detail in future experiments.

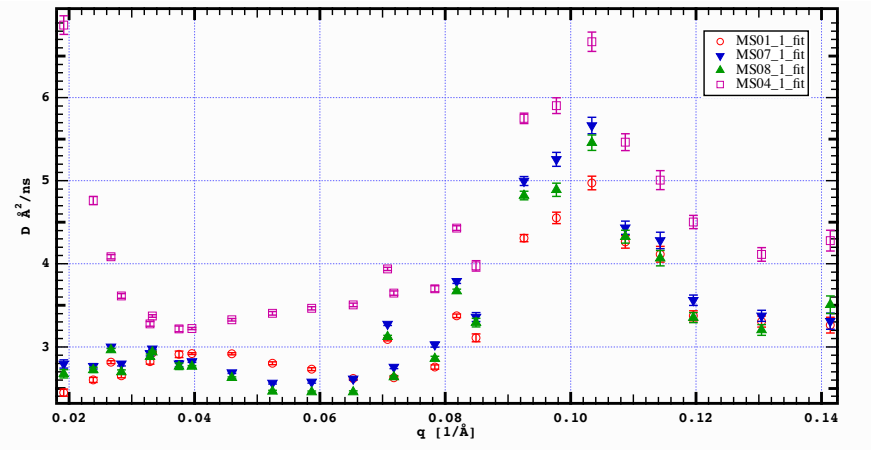

Figure 1: D_{eff} as a function of q for mixtures of the same droplet ME without any additional PE (purple squares), with 60 kg/mol (red circles), with 81 kg/mol HA (blue downward triangles) and 800 kg/mol HA (green upward triangles)