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Complexes of Oppositely Charged Microemulsions and Polyelectrolytes are Highly Dynamic

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Both Microemulsions and Polyelectrolytes are part of formulations in detergency and personal care products. Therefore, it is rather surprising that only little is known about their interactions. Here, we investigate the interactions of slightly positively charged oil in water droplet microemulsions consisting of the surfactants tetrradecyldimethylamine oxide and tetradecyltrimethylammonium bromide (TDMAO, TTAB 95:5 mol:mol), the cosurfactant 1-hexanol and the oil decance with different anionic polyelectrolytes.
Small angle neutron scattering (SANS) measurements show the formation of elongated aggregates. Measurements of the dynamics on different time and length scales through neutron spin-echo spectroscopy (NSE, up to hundreds of nanoseconds and tenths of nanometres) and dynamic light scattering (DLS, milliseconds and hundreds of nanometres) show qualitatively different behaviour. While NSE measurements show a bimodal relaxation with a fast mode corresponding to the diffusion of free ME droplets and a slower mode corresponding to the diffusion of the aggregates, DLS measurements show a monomodal decay with a diffusion coefficient between the two values obtained from NSE. This finding suggests that the aggregates observed by SANS are highly transient, with a life time between the nanoseconds time scale of NSE and the milliseconds timescale of DLS [1].
Simplistic random walk simulations show that the observed SANS patterns are compatible with free microemulsion droplets which are slowed down by a fixed factor in the immediate vicinity of the PE chain. This means that the formation of aggregates can be observed in SANS without any attractive interactions between the microemulsion droplets.

References
[1] M. Simon, M. Gradzielski. I. Hoffmann, Nanoscale Adv., 2020, 2, 4722.

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Sitzung Einordnung: Mounting Posters, Beer and light Dinner

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