Contribution ID: **13** Type: **Poster**

Probing topological interactions in polymers under shear

Tuesday 21 March 2023 16:00 (2 hours)

Wormlike micelles may serve as a model system for linear polymers and are studied extensively. Micelles, unlike polymers, can break and reform. Their self-assembled structure makes them unique in applications where high shear rates may be encountered, such as drag reduction, and as a templates for materials synthesis. The rheological properties of viscoelastic materials can be described by the Maxwellian model.
In this presentation we will present the influence of CTAB-NaSal solutions composition on the rheology of wormlike micelle and pave the road for microscopic investigation by neutron scattering. Fig. 1 shows the linear viscoelastic rheology of cationic wormlike micellar solution which has been shown to be Maxwellian, exhibiting a single dominant relaxation time.
To study the microscopic dynamics of wormlike micelles, they can be measured by neutron spin echo spectroscopy (NSE). However, such measurements under shear are challenging as Doppler scattering may depolarize the beam. In this presentation we will present a new dedicated sample cell to allow Rheo-NSE studies. We show resolution measurements and compare them to theoretical predictions of Doppler scattering. We show that our shear cell allows to address Fourier times up to 140ns at Q values of 0.157 Å-1 and shear rates of up to 166 s-1.

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Session Classification: Poster session TUESDAY

Track Classification: Soft Condensed Matter