Abstract Submitted
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Effect of micellar topology on shear rheology SIMON ROGERS, MICHELLE CALABRESE, NORMAN WAGNER, Univ of Delaware — Micellar topology affects the nonlinear shear rheology of self-assembled surfactant solutions. Segmental alignment of wormlike micelles (WLMs) exhibiting varying degrees of branching was investigated under shear in the flow-gradient and flow-vorticity planes using new small angle neutron scattering (SANS) sample environments. The degree of branching in mixed cationic/anionic surfactant (CTAT/SDBS) WLMs is controlled via the addition of the hydrotropic salt sodium tosylate. Shear-induced segmental alignment of the micelles is characterized by spatially-resolved flow-small angle neutron scattering (flow-SANS). Our ability to resolve structural projections in both planes provides insight to branch behavior and kinematics under shear flows. Local segmental orientation and alignment in the flow-gradient plane is a non-monotonic function of branching level and radial position. Alignment in the flow-gradient plane is significantly higher than that observed in the flow-vorticity plane, suggesting that branches may simultaneously migrate into the vorticity direction and inhibit spatially localized flows. Shear and normal stresses calculated from micellar alignment using the stress-SANS law are favorably compared with rheological measurements under identical conditions. The results provide evidence for the effects of micellar topology on the nonlinear shear rheology of WLM solutions.

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