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Branching, Chain Scission, and Solution Stability of Worm-Like Micelles. GREG BEAUCAGE, KARSTEN VOGTT, HANQUI JIANG, University of Cincinnati — As salt is added to a simple micelle solution such as SDS or SLES, the zero shear rate specific viscosity rises rapidly followed by a maximum and decay. The rapid rise in viscosity is associated with formation of elliptical and extended chain worm-like micelles, WLMs. Entanglement of these long chain micelles leads to the viscoelastic behavior we associate with shampoo and body wash. The plateau and drop in viscosity at high salt concentrations is caused by a special type of topological branching where the branch points have no energy penalty to motion along the chain according to Cates theory. These have some similarity to catenane crosslinks. Predictive dynamic theories for WLMs rely on structural details; the diameter, persistence length, contour length, branch length, segment length between branch points, and mesh size. Further, since the contour length and other large scale features are in kinetic equilibrium, with frequent chain breakage and formation, the thermodynamics of these long chain structures are of interest both in terms of chain scission as well as in terms of the stability of the colloidal solution as a whole. Recent structural studies of WLMs using static neutron scattering based on new scattering models will be presented demonstrating that these input parameters for dynamic models of complex topological systems are quantitatively and directly available. In this context it is important to consider a comparison between dynamic features, for instance entanglement, and their static analogs, chain overlap.

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