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The effect of pre-shear on the extensional rheology of wormlike micelle solutions AVINASH BHARDVAJ, DAVID RICHTER, JONATHAN ROTHSTEIN, University of Massachusetts — With the increasing application of wormlike micelles as rheological modifiers in many consumer products, the predictions of the behavior of these solutions have become increasingly important in the recent years. A complete understanding of the fluid behavior requires the knowledge of both the shear and extensional rheology of the wormlike micellar solutions. In this talk, we present the results of our experimental measurements of the transient uniaxial extensional viscosity of a series of wormlike micelle solutions, both with and without the application of a known pre-shear prior to the onset of stretch. Both CTAB/NaSal and CPyCl/NaSal micellar solutions of varying concentrations were tested over a progressively increasing range of extension rates, pre-shear rates and pre-shear durations in order to acquire a better insight into the extensional rheology and the effect of pre-shear. Pre-shear was found to delay the onset of strain hardening and the delay was found to increase with increasing pre-shear rate and pre-shear duration. At large enough extension rate, the fluid filaments have been observed not to fail under capillary thinning, but to rupture at a critical value of the elastic tensile stress. This failure has been found to be independent of the imposed extension rate, but a strong function of the pre-shear.

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