1052-76-334 **Pam Cook*** (cook@math.udel.edu), Dept Math Sciences, University of Delaware, Newark, DE 19716, and **Michael Cromer**, **Careth McKinley** and **Lin Zhou**. *Steady and transient flows of entangled fluids.*

Highly entangled systems such as wormlike micellar (surfactant) fluids exhibit spatially inhomogeneous shear-banding structures under deformation. Rheological equations of state capable of describing these fluids include a new model, the VCM model. This model specifically incorporates the rate-dependent breakage and reforming of the wormy micelles. The resulting coupled system of nonlinear partial differential equations describes the number density and stresses of each of the micellar species in addition to other stress-relaxation mechanisms. In shear flow the model predicts the localized shear-bands where the macroscopic field varies rapidly and the fluid microstructure is highly aligned. In filament stretching experiments elongating filaments suddenly rupture at high strain rates, a failure mechanism not related to the visco-capillary thinning observed in Newtonian fluids but due to a micellar failure event. This behavior is also captured by the model. The use of numerics and asymptotics to interrogate these models in transient and oscillatory shear, elongation, and pressure-driven flow in microfuidic devices will be described. Discussion of the use of related models to investigate other soft (biological materials) will be presented. (Received September 01, 2009)