Chapter 15

# Rheological Study of Polycrystalline Lyotropic Mesophases in the Cesium *n*-Tetradecanoate–Water System

**Peter K. Kilpatrick[1], Saad A. Khan[1], Akash Tayal[1], and John C. Blackburn[2]**

**[1]Department of Chemical Engineering, North Carolina State University, Raleigh, NC 27695**
**[2]Charleston Research Center, Westvaco, 5600 Virginia Avenue, North Charleston, SC 29406**

The dynamic elastic (G') and viscous (G") moduli of polycrystalline samples of lyotropic mesophases comprised of cesium n-tetradecanoate (CsTD) and water were measured by rheometry using the oscillatory shear technique. The phases and microstructural morphologies studied were (1) a smectic phase comprised of a hexagonal array of surfactant rodlike aggregates, (2) a ribbon phase comprised of a monoclinic array of deformed rodlike aggregates, and (3) a lamellar phase comprised of alternating layers of water and surfactant bilayer. Frequency-dependent measurements of the moduli show hexagonal and biaxial ribbon phase samples to behave as elastic, gel-like materials whereas the lamellar phase samples behave as viscous fluids. Apparent yield stress values were constructed for all samples by plotting $G'\gamma_0$ versus % strain ($\gamma_0$) at a frequency of 1 rad/sec. Values of apparent yield stress varying from 100-4500 Pa were obtained. The variation in apparent yield stress with CsTD concentration was consistent with the variation in mesophase equilibria and with the corresponding dimensionality of order in the phase.