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Structural dynamics of surfactant solutions in planar extensional flow BINBIN LUO, WESLEY BURGHARDT, Northwestern University — We report in situ x-ray scattering investigation of the structure of aqueous surfactant solutions in planar extensional flow. Samples were studied in a cross-slot stagnation flow cell fed by a syringe pump using a highly collimated synchrtron x-ray beam that provides for spatially resolved measurements of fluid structure in the stagnation region of the flow. Prior attempts to use planar stagnation flows for either x-ray or neutron scattering employed low-aspect ratio flow geometries in which the kinematics are dominated by parasitic velocity gradients along the incident beam direction. In contrast, our cross-slot flow cell employs an aspect ratio of 5:1, providing a much more ideal two-dimensional extensional flow field in the stagnation region. This device has been used to study two different surfactant systems, one a wormlike micelle solution at high salt concentration which exhibits rheology similar to that of entangled polymers. Here the focus is on the degree of micelle orientation produced as a function of extension rate. We have also studied a system that forms lamellar ordering. In addition to induced alignment of the mesophase structure, it is also possible to interrogate flow-induced changes in lamellar d-spacing in this material.

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