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Bistable Shear-Induced Alignment and Isotropy in Nematic Cylindrical Micelles LOUIS MADSEN, KYLE G. WILMSMEYER, XIAOLIN ZHANG, Department of Chemistry and Macromolecules and Interfaces Institute, Virginia Tech, Blacksburg, VA 24061 — Wormlike micelles (WLMs), such as cetyltrimethylammonium bromide in water, are long flexible cylinders of surfactant molecules that self-assemble as a function of concentration and temperature. By placing a driven rheological cell into an NMR instrument, we use "rheo-NMR" to correlate molecular-scale to micron-scale details available by NMR with macroscopic behaviors, with precise control over the sample shear rate. We directly observe alignment of WLMs induced by shear and magnetic field, as well as anisotropic diffusion, providing us with a nematic phase diagram that is modulated by shear. Here we focus on conditions where WLMs do not spontaneously field align (at 9.4 T), but rapidly and stably field align after application of shear. This "bistable" fluid persists in either the isotropic state or the field aligned state (after shearing) for > 12 hrs. We will further describe measurements of the nonlinear dynamics of director reorientation, with which we quantify anisotropic elastic constants and viscosities.

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