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Shear banding in complex fluids: Hints from colloidal crystals[1]

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When sheared out of equilibrium, a variety of complex fluids exhibit an unusual behavior, where bands of high and low shear rates are spontaneously formed. This phenomenon is typically attributed to a nonlinear material rheology. In this talk I will describe a similar phenomenon observed in oscillatory shear experiment on dense colloidal crystal, where the data reflect a linear, rather than nonlinear material rheology. This observation suggests an alternative mechanism for shear banding, as a coexistence under nonequilibrium conditions between two linearly responding phases of a complex fluid. Some consequences will be discussed, such as the singular role played by near-wall pure solvent layers, and possible nonequilibrium mechanisms for selection of the observed band width.

[1]Collaboration with: Itai Cohen, Michael P. Brenner, and David A. Weitz