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Shear-Induced Transitions and Instabilities in Surfactant Wormlike Micelles

Sandra Lerouge and Jean-François Berret

Abstract In this review, we report recent developments on the shear-induced transitions and instabilities found in surfactant wormlike micelles. The survey focuses on the nonlinear shear rheology and covers a broad range of surfactant concentrations, from the dilute to the liquid-crystalline states and including the semidilute and concentrated regimes. Based on a systematic analysis of many surfactant systems, the present approach aims to identify the essential features of the transitions. It is suggested that these features define classes of behaviors. The review describes three types of transitions and/or instabilities: the shear-thickening found in the dilute regime, the shear-banding which is linked in some systems to the isotropic-to-nematic transition, and the flow-aligning and tumbling instabilities characteristic of nematic structures. In these three classes of behaviors, the shear-induced transitions are the result of a coupling between the internal structure of the fluid and the flow, resulting in a new mesoscopic organization under shear. This survey finally highlights the potential use of wormlike micelles as model systems for complex fluids and for applications.

Keywords Instabilities under shear · Lyotropic mesophases · Shear-banding · Shear-thickening · Surfactant · Viscoelasticity · Wormlike micelles

Contents

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