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Analysis of the plane Poiseuille flow of a wormlike micellar solution with shear banding BENJAMIN M. MARIN-SANTIBANEZ, JOSE PEREZ-GONZALEZ, LOURDES DE VARGAS, Instituto Politecnico Nacional, Mexico, JEAN PAUL DECRUPPE, Universite de Metz, France, GUADALUPE HUELSZ, Universidad Nacional Autonoma de Mexico, Mexico — In this work a detailed study of the plane Poiseuille flow of a shear banding wormlike micellar aqueous solution is presented. The experiments were carried out at 27.5 °C under controlled pressure using a transparent flow cell, where simultaneous measurements of polarimetry, pressure drop and flow rate were performed in order to assess the flow stability. Particle image velocimetry was also used to analyze the flow kinematics upstream of the contraction. Five different regimes were observed in the flow curve, as well as the development and growth of shear bands right before the spurt. After the transition to the high shear branch, the flow became unstable and was composed by asymmetric shear bands of structured and isotropic fluid, which oscillated with respect to the zero-shear plane. Symmetric lip vortices were observed to grow and suddenly decrease under unstable flow conditions upstream of the contraction. The shear bands oscillated in the same way as upstream vortices with a frequency that increased along with flow rate. The oscillating flow upstream of the contraction arises from changes in the vortices size and produced jets or spurts of highly oriented material followed by recoiling of the micellar solution.

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