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Linear Instabilities in Simple Shear Flow of Polymer Solutions Driven by Stress-gradient/Concentration Coupling GARY LEAL, MICHAEL CROMER, MICHAEL VILLET, GLENN FREDRICKSON, University of California, Santa Barbara — Inhomogeneities in the flow of polymer solutions have been observed in experiment over the last 40 years, e.g. including the well studied formation of shear bands in a linear shear flow device. In this study we investigate the role of concentration non-uniformities in causing hydrodynamic instabilities in a linear shear flow. To incorporate a stress-concentration coupling we follow a two-fluid model formalism, in which the polymer conformation is described by the Rolie-Poly model. In a shear flow, the model may exhibit linear instability due to perturbations in the gradient direction, even for a monotonic constitutive curve, provided there is a sufficient separation between the characteristic polymer relaxation times. We show that the mechanism driving the instability is the motion of polymer up stress gradients, leading to concentration nonuniformities in the flow.

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