Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Linear stability analysis of a miscible two-layer power-law fluid in Couette flow[1] THOMAS WARD, TEJASWI SOORI, Iowa State University — We examine the stability of a miscible two-layer power-law fluid in a 2D shear flow. The problem is motivated by recent experiments showing that miscible displacement of shear-thinning fluids yields an instability. To study fluid stability we analyze the mass, momentum and species conservation equations in a Couette flow geometry. Layer depth, consistency and power-law index are varied for zero wall slip conditions. We also examine the interface by treating the two-layer problem as a two-fluid one with zero surface tension. The governing equations are linearized about base states to estimate growth rates for dependent variables in the limit of infinitesimally small disturbances. We integrate the resulting ODE equations using a standard Chebyshev collocation method. We also compare results with prior ones for two-fluid layer and miscible two-layer problems, along with critical values observed in experiments.

[1]ACS-PRF

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Date submitted: 01 Aug 2019 Electronic form version 1.4