Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Flow Visualization and Velocity Spectra in a Low Viscosity Round Jet. VINOD SRINIVASAN, IAN WRIGHT, University of Minnesota — Low-density jets are known to exhibit strong nonlinear global modes, whose frequency is dependent on the density ration, boundary layer thickness with a weak dependence on viscosity. The separate role of viscosity gradients has not been investigated experimentally for free shear flows such as round jets. The present research documents the unstable response of a circular jet issuing into an ambient fluid of higher viscosity. Viscosity ratios (ambient-to-jet) of 1 to 40 and jet Reynolds numbers of 500 to 2000 are studied in density-matched, miscible fluids. The mode of breakdown is visualized using fluorescent dye and hydrogen bubble techniques, while the wavelength of the dominant mode is measured through hot-film anemometry. The spatial and temporal growth of instabilities is reported as dependent on viscosity ratio, Reynolds number, and jet shear layer inlet condition. The breakdown process is marked by the emergence of a sharp peak in the frequency spectrum at a distance of half a jet diameter downstream of the exit plane. This peak persists for about 5 diameters downstream, gradually decreasing in magnitude until indistinguishable from the background. The frequency of the peak depends on the viscosity ratio, for any fixed jet Reynolds number.

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Date submitted: 02 Aug 2019 Electronic form version 1.4