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Instability of the air cavity of a micellar solution in the wake of a submerged rod THOMAS OBER, GARETH MCKINLEY, Dept of Mechanical Eng, MIT, SUNGHWAN JUNG, Dept. of Math, MIT — The behavior of flowing surfactant and polymeric solutions is of increasing importance as these materials are used more commonly as rheological modifiers. Here, we investigate the instability of the air cavity formed in the wake of a rod, which is submerged in the oncoming stream of a non-Newtonian fluid with a free surface exposed to air. Two fluid systems with different concentrations of cetylpyridinium chloride (CPyCl), sodium salicylate (NaSal) and NaCl are studied. Under certain conditions, the cavity exhibits a repeating tooth-like pattern, whose wavelength and amplitude vary with depth, rod diameter, oncoming velocity and fluid properties. We characterize experimentally the cavity closing dynamics, and the wavelength and amplitude along the profile of the cavity, probing the interplay between viscoelasticity, inertia and hydrostatic pressure in our experiments. Finally, we propose a simple model to capture the some of the key features of the dynamics of the air cavity.

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