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Surfactant effects in dynamics and breakup of a contracting liquid filament QI XU, OSMAN BASARAN, School of Chemical Engineering, Purdue University, W. Lafayette — The effects of a monolayer of insoluble surfactant on the dynamics of contraction and breakup of a liquid filament in air are studied by solving numerically the Navier-Stokes system that governs the time evolution of the filament shape and the velocity and pressure fields within it and the time-dependent convection-diffusion equation that governs surfactant transport on the air-liquid interface. Five dimensionless parameters govern this free boundary problem: dimensionless filament half-length L, Ohnesorge number Oh (viscous/capillary force), dimensionless initial surfactant loading Γ, a parameter β which provides a measure of the strength of the surfactant, and surface Peclet number Pe (convection/diffusion of surfactant). Computational results show that when Pe is low, Marangoni effects are weak and the dynamics closely resemble those of a surfactant-free filament. In contrast, when Pe is high, Marangoni stresses can prevent filament breakup via the end-pinching mode. Vorticity dynamics within the filament are also examined to help shed light on the fluid mechanics of the contraction process.

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