

Abstract Submitted
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Precipitative Growth Templated by a Fluid Jet¹ DAVID STONE, BRADDON LEWELLYN, JAMES BAYGENTS, RAYMOND GOLDSTEIN, University of Arizona — Tubular growth by chemical precipitation at the interface between two fluids, a jet and its surroundings, underlies the development of such important structures as chimneys at hydrothermal vents. This growth is associated with strong thermal and/or solute gradients localized at those interfaces, and these gradients, in turn, often produce radial compositional stratification of the resulting tube wall. A fundamental question underlying these processes is how the interplay between diffusion, advection, and precipitation determines the elongation rate of the tubes. Here we report experimental and theoretical results which reveal a regime in which there exists a new scaling law for tube growth. The model system studied consists of a jet of aqua ammonia injected into a ferrous sulfate solution, precipitating iron hydroxides with varying oxidation states at the jet boundary. Despite the complex chemistry and dynamics underlying the precipitation, the tube growth exhibits a strikingly simple scaling form with characteristic lengths and times increasing linearly with the mean velocity of the jet. These observations are shown to follow from a kinetic model of advection-dominated flows.

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