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Fingering Instabilities in Oxidizing Eutectic Gallium-Indium KEITH HILLAIRE, North Carolina State University, WILLIAM LLANOS, Chicago State University, MICHAEL DICKEY, KAREN DANIELS, North Carolina State University — Eutectic gallium-indium (eGaIn), a room-temperature liquid metal alloy, has the largest tension of any liquid at room temperature, and yet can nonetheless undergo fingering instabilities. This effect arises because, under an applied voltage, an oxide builds up on the surface of the metal. The oxide acts like a surfactant, lowering the surface tension and allowing spreading under gravity. In the experiments described here, we examine the hypothesis that fingering instabilities, including tip-splitting, arise due to Marangoni instabilities. Our experiments are performed with eGaIn droplets placed in an electrolyte bath of sodium hydroxide; by placing the eGaIn on copper electrodes, which eGaIn readily wets, we are able to impose a fingering wavelength on the spreading. Two transitions are observed as a function of current: (1) a minimum current at which EGaIn spreads out from the copper electrode; (2) the current at which the fingers become unstable to shorter wavelengths and spread inhomogeneously. We present a phase diagram as a function of current and initial wavelength, and identify a minimum wavelength below which single tip-splitting does not occur.

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