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**Oxidation-Mediated Fingering in Liquid Metals** KAREN DANIELS, COLLIN EAKER, DAVID HIGHT, JOHN O'REGAN, MICHAEL DICKEY, North Carolina State Univ — We identify and characterize a new class of fingering instabilities in liquid metals; these instabilities are unexpected due to the large interfacial tension of metals. Electrochemical oxidation lowers the effective interfacial tension of a gallium-based liquid metal alloy to values approaching zero, thereby inducing drastic shape changes, including the formation of fractals. The measured fractal dimension ( $D = 1.3 \pm 0.05$ ) places the instability in a different universality class than other fingering instabilities. By characterizing changes in morphology and dynamics as a function of droplet volume and applied electric potential, we identify the three main forces involved in this process: interfacial tension, gravity, and oxidative stress. Importantly, we find that electrochemical oxidation can generate compressive interfacial forces that oppose the tensile forces at a liquid interface. Thus, the surface oxide layer not only induces instabilities, but ultimately provides a physical and electrochemical barrier that halts the instabilities at larger positive potentials.

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