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Development of the striation and filament form of the electrothermal instability[1] EDMUND YU, T.J. AWE, W.G. YELTON, B.B. MCKENZIE, K.J. PETERSON, Sandia National Labs, B.S. BAUER, T.M. HUTCHINSON, University of Nevada, S. FUELLING, Sandia National Labs, K.C. YATES, G. SHIPLEY, University of New Mexico — Magnetically imploded liners have broad application to ICF, dynamic material property studies, and flux compression. An important consideration in liner performance is the electrothermal instability (ETI), an Ohmic heating instability that manifests in 2 ways: assuming vertical current flow, ETI forms hot, horizontal bands (striations) in metals, and vertical filaments in plasmas. Striations are especially relevant in that they can develop into density perturbations, which then couple to the dangerous magneto Rayleigh-Taylor (MRT) instability during liner acceleration. Recent visible emission images of Ohmically heated rods (Awe et al., IEEE Trans. Plasma Sci., 45, 584-589 (2017)) show evidence of both the striation and filament form of ETI, suggesting several questions: (1) can simulation qualitatively reproduce the data? (2) If so, what seeds the striation ETI, and how does it transition to filaments? (3) Does the striation develop into a strong density perturbation, important for MRT? In this work, we use analytic theory and 3D MHD simulation to study how isolated resistive inclusions, embedded in a perfectly smooth rod and communicating through current redistribution, can be used to address the above questions.

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