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Electroconvection near a metal electrode surface[1] GAOJIN LI, LYNDEN ARCHER, DONALD KOCH, Cornell University — Electroconvection in electrodeposition leads to fast dendrite growth undermining the efficacy of the process. Above a critical voltage, the electrohydrodynamic instability generates an electro-osmotic slip velocity at the edge of the space charge layer, creating convective flows in the electrolyte which cause an overlimiting current and a nonuniform ion flux. The nonuniform deposition of cations on a metal anode and its coupling with the electroconvection cause fast dendrite growth and lead to premature cell failure. The deposition rate of cation on the metal surface, which is described by the well-known Butler-Volmer equation, determines the ion transport below the limiting current. However, how does it affect the electroconvection in the overlimiting regime is not clear yet. In this work, we use the stability analysis and direct numerical simulation to investigate the linear instability and the dynamics of the electroconvection.

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