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Nonlinear shape evolution of electromigration-driven single-layer islands[1]

JOACHIM KRUG, University of Cologne

Electromigration is the transport of matter induced by an electric current in the bulk or at the surface of a conducting material. Electromigration along interfaces and grain boundaries is a central factor limiting the reliability of integrated circuits. This has motivated numerous theoretical studies of the shape evolution of voids in metallic thin films caused by electromigration along the void boundary [1]. In this case the coupling of the void shape to the current distribution in the film leads to a nonlocal moving boundary problem driven by a mass current *tangential* to the boundary. Here we are concerned with the *local* version of the problem, which applies to the electromigration of single-layer islands on metallic surfaces [2]. We show that the introduction of crystal anisotropy in the mobility of atoms along the island boundary induces a rich variety of dynamical behaviors, ranging from spontaneous symmetry breaking to periodic and chaotic modes of island migration [3]. Under suitable physical conditions these phenomena can be reproduced in kinetic Monte Carlo simulations of a realistic microscopic model of the Cu(100) surface. Finally, we discuss recent results on the electromigration of vacancy islands in the kinetic regime dominated by exchange with the adatom diffusion field *inside* the island. The talk is based on joint work with P. Kuhn, F. Hausser, A. Voigt and M. Rusanen. [1] M. Schimschak, J. Krug, J. Appl. Phys. **87**, 685 (2000). [2] O. Pierre-Louis, T.L. Einstein, Phys. Rev. B **62**, 13697 (2000). [3] P. Kuhn, J. Krug, F. Hausser, A. Voigt, Phys. Rev. Lett. **94**, 166105 (2005).

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