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Reactive dewetting of metal nanofilms under pulsed laser melting[1] R. SURESHKUMAR, L. LANE, Washington University, Saint Louis, WASHINGTON UNIVERSITY TEAM — Ordered metal nanoparticle arrays on dielectric or photoconducting substrates exhibit unique optical properties arising from resonant interactions between the photons and localized surface plasmons. A promising route to the fabrication of such structures utilizes pattern forming hydrodynamic instabilities of an ultra thin (1-10 nm) molten metal film. The preferred length scales of the pattern depend on interfacial tension, contact angle with the substrate and long range dispersion forces (Trice et al. PRL, 101, 017802 (2008)). In this work, we examine the effect of film-substrate interactions on pattern selection. These interactions for instance could arise from the chemical affinity of the metal to the substrate. A mathematical model based on the classical thin film hydrodynamic equation is developed in which the metal-substrate interactions are modeled by a diffusion potential. The presence of the diffusion potential damps the growth of thermal perturbations by intermolecular forces and increases the wavelength of the fastest growing normal mode, implying that the spacing between the particles formed upon film rupture would increase as well.

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