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Morphology of a Solidifying Thin Film MICHAEL BEERMAN, LUCIEN BRUSH, UNIVERSITY OF WASHINGTON, DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING, SEATTLE, WA 98195 USA TEAM — A pair of coupled non-linear partial differential equations is derived using lubrication theory, governing the morphology of a pure, thin, liquid film, bounded by its solid phase and passive gas phase. Both the no-slip solid-liquid (SL) and the free liquid-gas (LG) interfaces are deformable. In the isothermal case with a rigid SL interface, this system reduces to that studied by Williams and Davis (1982). Linear analysis of a uniform film reveals stationary and oscillatory instabilities which depend on capillary, latent heat, van der Waals, Marangoni, heat transfer and volume change effects. Numerical solutions of the fully non-linear system provide film evolution and rupture times. It is found that for a variety of linearly unstable initial conditions, as the film thins and nears rupture, the SL interface retreats by melting away from the tip region of the encroaching LG interface.

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