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Suppressing van der Waals rupture of thin films by imposed shear flow[1] MICHAEL DAVIS, STEPHEN DAVIS, Department of Engineering Sciences and Applied Mathematics, Northwestern University — It is known that thin viscous films subject to attractive van der Waals forces will rupture in finite time due to a long-wave instability. We have studied the effects of applying a shear stress to the free surface of a film on a substrate, and found that it stabilizes perturbations in the direction of shear flow, thereby retarding rupture, or even suppressing rupture entirely for shear stress above a critical value. Perturbations orthogonal to the shear flow are not stabilized, and therefore a unidirectional shear will not prevent rupture in a three- dimensional viscous film. However, it may be possible to stabilize the film in all directions through the application of a rotating shear stress.

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