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Suppressing van der Waals driven rupture through shear¹ MICHAEL DAVIS, MICHAEL GRATTON, STEPHEN DAVIS, Department of Engineering Sciences and Applied Mathematics, Northwestern University — A thin viscous film on a substrate is susceptible to rupture instabilities driven by van der Waals attractions. When a sufficiently large shear is applied to the free surface, the rupture instability is suppressed in two dimensions for sufficiently large shear magnitude and replaced by a permanent finite amplitude travelling wave with speed approximately equal to the speed of the surface. For small amplitudes, the wave is governed by the Kuramoto-Sivashinsky equation. If three- dimensional disturbances are allowed, the shear is decoupled from perpendicular disturbances to the flow, and line rupture would occur. In this case, replacing the unidirectional shear with a rotating shear can suppress rupture for suitable choices of shear magnitude and angular velocity.

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