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Impact of a vibration on the behavior of a dewetting thin film

ALEKSEY ALABUZHEV, Institute of Continuous Media Mechanics, Perm, Russia, SERGEY SHKLYAEV, Perm State University, Russia, MIKHAIL KHENNER, State University of New York at Buffalo, Buffalo, USA — It is well known that volatile van der Waals thin films often dewet from a substrate and rupture. Thus is it important to identify and study physical mechanisms that can suppress dewetting instability. We have found that vibration of the substrate, which has been studied previously in the context of thick films, can provide desired stabilization. The large differences in characteristic length and time scales make possible the application of the time-averaging methods from the dynamical systems theory for the analysis of film dynamics. Using these methods, we obtained the nonlinear amplitude equation for the film thickness. We show that horizontal vibration produces a finite impact on the dynamics of the film when the amplitude the vibration is of the order of the film thickness. When vibration is vertical, its amplitude must be larger than the film thickness. Stabilization of the film is possible only in the latter case.

Aleksey Alabuzhev
Institute of Continuous Media Mechanics

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