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Oscillatory instability of a self-rewetting film driven by thermal modulation WILLIAM BATSON, YEHUDA AGNON, ALEX ORON, Technion-Israel Institute of Technology — Here we consider the self-rewetting fluids (SRWFs) that exhibit a well-defined minimum surface tension with respect to temperature, in contrast to those where surface tension decreases linearly. Utilization of SRWFs has grown significantly in the past decade, due to observations that heat transfer is enhanced in applications such as film boiling and pulsating heat pipes. With similar applications in mind, we investigate the dynamics of a thin SRWF film which is subjected to a temperature modulation in the bounding gas. A model is developed within the framework of the long-wave approximation, and a time-averaged thermocapillary driving force for destabilization is uncovered for SRWFs that results from the nonlinear surface tension. Linear analysis of the nonlinear PDE for the film thickness is used to determine the critical conditions at which this driving force destabilizes the film, and, numerical integration of this evolution equation reveals that linearly unstable perturbations saturate to regular periodic solutions (when the modulational frequency is set properly). Properties of these flows such as bifurcation and long-domain flows, where multiple unstable linear modes interact, will also be discussed.

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