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Faraday instability on patterned surfaces JIE FENG, GREGORY RUBINSTEIN, IAN JACOBI, HOWARD STONE, Princeton University — We show how micro-scale surface patterning can be used to control the onset of the Faraday instability in thin liquid films. It is well known that when a liquid film on a planar substrate is subject to sufficient vibrational accelerations, the free surface destabilizes, exhibiting a family of non-linear standing waves. This instability remains a canonical problem in the study of spontaneous pattern formation, but also has practical uses. For example, the surface waves induced by the Faraday instability have been studied as a means of enhanced damping for mechanical vibrations (Genevaux, et. al. 2009). Also the streaming within the unstable layer has been used as a method for distributing heterogeneous cell cultures on growth medium (Takagi, et al. 2002). In each of these applications, the roughness of the substrate significantly affects the unstable flow field. We consider the effect of patterned substrates on the onset and behavior of the Faraday instability over a range of pattern geometries and feature heights where the liquid layer is thicker than the pattern height. Also, we describe a physical model for the influence of patterned roughness on the destabilization of a liquid layer in order to improve the design of practical systems which exploit the Faraday instability.

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