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Dynamics of oil film spreading and dewetting on aqueous substrates JIE FENG, OREST SHARDT, HOWARD A. STONE, Department of Mechanical and Aerospace Engineerng, Princeton University — The spreading and dewetting dynamics of liquids on substrates has been studied intensively in recent years because of their fundamental role in nature and fluid dynamics, as well as practical relevance to many technological processes, such as coating flows. However, little is known about the wetting dynamics in a state called pseudo-partial wetting, which can contribute to efficient interfacial emulsification by bubble bursting. Here we describe the dynamics of the rim that forms when an oil film dewets in a pseudo-partial wetting state on an aqueous substrate. We observe that the rim around the expanding hole displays an instability which leads to the rim break-up into a series of humps. By using confocal microscopy and systematically manipulating the parameters of the multi-phase system, we quantify the dynamics of the oil rim and the formation of humps. We further study the mechanism underlying the break-up of the retracting oil rim. In particular, we theoretically explain the critical conditions at which humps form and highlight the roles of competing time scales during hole expansion and the growth of oil humps. Our work not only contributes to the fundamental understanding of film dynamics in pseudo-partial wetting but also may help improve the understanding and utilization of liquid film flows in industrial processes.

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