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Particle induced air bubble break-up in a Hele-Shaw cell[1] PENG ZHANG, JOHN MINES, Department of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA 24061, SUNGYON LEE, Department of Mechanical Engineering, Texas A&M University, College Station, Texas 77843, SUNGHWAN JUNG, Department of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA 24061 — Hydrodynamic interactions of drops and bubbles with particles in viscous fluids are important in the multiphase separation and reaction processes. In the present work, we explore the fundamental mechanism of such complex processes by studying the collision of a single bubble with a fixed solid particle inside a Hele-Shaw cell. Physical experiments show that an air bubble either splits or slides around the particle depending on the initial transverse offset between the bubble and particle centroids. A bubble slides around the particle until the offset is decreased below a critical value, in which case the bubble splits into two daughter bubbles. We are able to predict this slide-split transition using a theoretical model that compares the relative change in surface energy, gravitational potential and viscous dissipation in the two regimes.

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