

Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Evaporation-Induced Breakup of a Droplet in a Shallow Well

KRIS F. WIEDENHEFT, H. ALEX GUO, Department of Mechanical Engineering and Materials Science, Duke University, Durham, North Carolina 27708, THOMAS P. WITELSKI, Department of Mathematics, Duke University, Durham, North Carolina 27708, CHUAN-HUA CHEN, Department of Mechanical Engineering and Materials Science, Duke University, Durham, North Carolina 27708 — Droplet evaporation is most frequently studied on a flat substrate, for which surface defects are typically accounted for by contact angle hysteresis. To directly investigate the effect of surface defects, we study droplet evaporation in a shallow circular well, created by etching a smooth silicon substrate. An inkjet printed water droplet first spreads over the entire well, and then evaporates into the air until its contact line is pinned at the top edge of the well. From this point on, the droplet evaporation shows complex patterns, including an annular breakup away from the walls of the well. This annular breakup presents a drop evaporation mode that is distinct from the widely reported modes with constant contact angle or constant contact radius. We have developed a thin-film evaporation model that captures the annular breakup pattern as well as the range of aspect ratio conducive to the breakup.

Kris Wiedenheft
Dept of Mechanical Engineering and Materials Science, Duke Univ.

Date submitted: 01 Aug 2019

Electronic form version 1.4