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Thin-Film Breakup Dynamics of a Binary Mixture Drop during Evaporation 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 — When a drop consisting of two volatile liquids evaporates on a solid substrate, the parent drop frequently bursts into tiny droplets. Although the bursting originates from solutal Marangoni stresses, like the wine-tear phenomenon, the binary-drop setup is distinct with its moving contact line and the dramatic bursting of the entire parent drop before complete evaporation. For a drop of water and isopropanol, a ridge develops at the contact line when the drop spreads on the silicon substrate. When evaporation drives the contact line to eventually recede, the ridge formed during spreading fragments into tiny droplets. We have developed a numerical model for the thin-film evolution of the binary drop. The model accounts for the liquids differential evaporation, which generates Marangoni stresses. Our model captures the ridge formation process, and predicts a threshold mixing ratio for the Marangoni bursting that is experimentally observed.

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