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Breakup of rivulet falling over an inclined plate. RAJESH SINGH, JANINE GALVIN, National Energy Technology Laboratory — The multiscale modeling of solvent absorption in a structured packing is a complex problem. The local hydrodynamics in the packing, specifically existing flow regimes, is a key factor for overall efficiency. A single packing unit is made of corrugated sheets arranged perpendicularly to each other. In this effort, breakup of rivulet over an inclined plate is examined, which might be helpful to explain some fundamental aspects of this system. Rivulet breakup is a complex phenomenon dictated by many factors such as solvent physical properties, contact angle (γ), inertia, plate inclination angle (θ), etc. The multiphase flow simulations using the volume of fluid method were conducted considering these factors. Decreasing solvent flow rate results in the transition of flow regimes from a film to a rivulet and then to a droplet. Demarcation between a stable and an unstable flow regime that leads to breakup is presented in terms of the critical Weber number (We_{cr}). Values of Weber number below We_{cr} correspond to breakup behavior and above to a stable rivulet. The impact of solvent properties is presented by the Kapitza number (Ka), which only depends on fluid properties. Variation of We_{cr} with Ka shows two trends depending on the Ka value of the solvent. Solvents with low Ka show a linear variation of We_{cr} with Ka whereas those with high Ka show a quadratic variation. The effect of plate inclination on the rivulet breakup reveals that We_{cr} decreases with increased θ value. In addition, higher values of γ promote breakup.

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