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Film flow over an inclined plate: effects of solvent properties and contact angles RAJESH SINGH, JANINE GALVIN, National Energy Technology Laboratory, Albany — The liquid film behavior on the structured packing is a key aspect to the overall efficiency of the column. In this context, the effects of solvent properties and contact angle (γ) on the hydrodynamics of film flow are systematically investigated. Specifically, multiphase flow simulations for film flow over an inclined plate are carried out using volume of fluid method. A scaling analysis for film thickness and interfacial area was performed. Accordingly, a theory for film thickness and wetted area in terms of Kapitza number (Ka) is proposed. The advantage of the Ka is that it only depends on fluid properties and independent of flow parameters. Therefore the Ka becomes fixed for a given solvent and it decreases with increasing solvent viscosity. The results show that for a fully wetted plate the film thickness (δ) decreases with increasing Ka number as $\delta \sim 1/Ka^{1/4}$. For rivulet flow, the interfacial area (A_{In}) is found to decrease with increasing Ka value. Indeed, scaling analysis shows the relation $A_{In} \sim 1/Ka^{1/2}$. The effect of varying contact angle on the hydrodynamics of rivulet flows was also investigated. The contact angle has no impact on the film thickness for a fully wetted plate but strongly influences the interfacial area for the case of partially wetted plate. For rivulet flow the interfacial area increases with increasing contact angle and is holds the relation $A_{In} \sim 1/(1-\cos\gamma)^m$ for a wide range of contact angle. The value of exponent m depends on the Ka number and shows two values, one for medium to high surface tension and another for low surface tension value.

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