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Dry patches in a flowing film : Predicting rewetting and the effects of inertia LUC LEBON, Laboratoire Matiere et Systemes Complexes (MSC), CNRS / Univ. Paris 7, JULIEN SEBILLEAU, IMFT / Univ. Toulouse, LAURENT LIMAT, Laboratoire Matiere et Systemes Complexes (MSC), CNRS / Univ. Paris 7
— We study the effects of inertia on the shape and stability of dry patches using liquids of decreasing viscosities. These dry patches are formed when a liquid film flows down along a substrate under partial wetting conditions. They become stationary and exhibit an arch shape well described by a simple viscous model developed long ago by Podgorski. Surprisingly, this arch shape appears to be robust when one decreases the fluid viscosity which increases inertial effects, but the evolution of the apex curvature upon flow rate is strongly affected. We here proposed an improved description of the dry patch evolution taking into account several physical effects as the hydrostatic pressure in the liquid film, the curvature of the contact line, and these inertial effects. These ones affect both the mechanical equilibrium of the rim surrounding the dry patch and the flow inside the rim. This model allows us to show that the dry patch shape remains extremely close to the viscous -Podgorski- prediction but with a rescaling of the apex curvature. It also allows us to get a better prediction of the apex curvature dependence upon flow rate and a prediction of the rewetting threshold above which dry patches are swept away by the film flow.

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