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Gravity-driven propagation of thin non-isoviscous rivulets on vertical and inclined planes ANDREY FILIPPOV, GAOZHU PENG, Corning Incorporated — Many practical problems require the spreading of a liquid on a solid. In the glass industry, flows of molten glass on a vertical or inclined, in respect to the vertical, solid refractory surface are parts of several important applications. In present paper, propagation of a thin and relatively narrow rivulet on vertical and inclined solid planar surface is considered within a mathematical frame of general lubrication theory, using a commercially available PDE solver. In contrast to most of previous studies, the addressed flows are gravity driven, and the coefficient in front of the surface tension term in the dimensionless equations (the inverse Bond number) is small and does not exceed 10^{-5}. It has been found that the flow pattern strongly depends on the inclination angle. For example, the contact line of rivulets propagating on vertical and negatively inclined plates becomes unstable, sending ahead one or several smaller forerunner rivulets (fingers) having a higher amplitude and moving faster than the main rivulet. This instability is similar to fingering instability of infinite films on solid surfaces, but the pattern of the flow is symmetric in respect to the middle line of the rivulet rather than a periodic. In the case of the gradient of viscosity applied in the cross-direction to the main flow, the symmetry breaks and motion of both main rivulet and forerunners is diverted in the direction of areas with lower viscosity.

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