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Stability of flow focusing: The minimum attainable flow rate J.M. MONTANERO, N. REBOLLO, A. ACERO, C. FERRERA, University of Extremadura, M.A. HERRADA, A.M. GANAN-CALVO, University of Seville — We analyze both theoretically and experimentally the stability of the steady jetting regime reached when liquid jets are focused by coaxial gas streams. In the low-viscosity case, viscous dissipation in the feeding capillary and liquid meniscus seem to be the origin of the instability. For high-viscosity liquids, the breakdown of the jetting regime takes place when the pressure drop cannot overcome the resistance force offered by surface tension. The characteristic flow rates for which the tapering menisci become unstable do not depend on the pressure drop applied to the system to produce the micro-jet. They increase (decrease) with viscosity for very low (high) viscosity liquids. Experiments confirmed the validity of the above conclusions. For each applied pressure drop, there is a minimum liquid flow rate below which the liquid meniscus drips. The minimum flow rates become practically independent of the applied pressure drop for sufficiently large values of this quantity. There exists an optimum value of the capillary-to-orifice distance for which the minimum flow rate attains a limiting value, which constitutes the lowest flow rate attainable with a given configuration in the steady jetting regime. A two-dimensional stability map with a high degree of validity is plotted on the plane defined by the Reynolds and capillary numbers based on the limiting flow rate.

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