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Thermocapillary control of rupture in viscous fluid sheets.

Technological applications in inkjet printing and in advanced soldering techniques require the formation of precise drop volumes from jet sources. One potential method of forming these drops has been the use of a laser which imparts a spatially distributed temperature profile in the fluid, after which thermocapillary forces act on the fluid motion and drive the rupture of the film at a precise location. Our study investigates the limiting ranges of this technique on a thin viscous fluid sheet. For varicose disturbances, the long-wave approximation results in a system of three coupled nonlinear evolution equations that describe the sheet thickness, the mean axial velocity and the average sheet temperature. Successful location of the rupture location is possible for relatively small values of the Marangoni number. We discuss the implications of these results to cylindrical jets. (Received February 04, 2005)