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Explicit demonstration of the role of Marangoni effect in the breakup of nanoscale liquid filaments[1] IVANA SERIC, New Jersey Institute of Technology, KYLE MAHADY, University of Tennessee, SHAHRIAR AFKHAMI, New Jersey Institute of Technology, CHRIS HARTNETT, JASON FOWLKES, PHILIP RACK, University of Tennessee, LOU KONDIC, New Jersey Institute of Technology — We consider a breakup of bi-metal filaments deposited on a solid substrate. These filaments are exposed to laser irradiation and, while in the liquid phase, evolve by a process resembling breakup of a liquid jet governed by the Rayleigh-Plateau instability. The novel element is that the Marangoni effect, resulting from a different surface tension of the two metals from which the filament is built, is crucial in understanding the instability development. In particular, Marangoni effect may lead to the inversion of the breakup process, producing droplets at the locations where according to the Rayleigh-Plateau theory dry spots would be expected. We present experimental results carried out with Cu-Ni filaments, as well as direct numerical simulations based on a novel algorithm that includes variable surface tension in a Volume-of-Fluid based Navier-Stokes solver. These results suggest the possibility of using Marangoni effect for the purpose of self- and directed-assembly on the nanoscale.

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