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Vibration Induced Microfluidic Atomization LESLIE YEO, AISHA QI, JAMES FRIEND, Micro/Nanophysics Research Laboratory, Monash University — We demonstrate rapid generation of micron aerosol droplets in a microfluidic device in which a fluid drop is exposed to surface vibration as it sits atop a piezoelectric substrate. Little, however, is understood about the processes by which these droplets form due to the complex hydrodynamic processes that occur across widely varying length and time scales. Through experiments, scaling theory and numerical modelling, we elucidate the interfacial destabilization mechanisms that lead to droplet formation. Droplets form due to the axisymmetric break-up of cylindrical liquid jets ejected as a consequence of interfacial destabilization. Their 10 μm size correlates with the jet radius and the instability wavelength, both determined from a viscous-capillary dominant force balance and confirmed through a numerical solution. With the exception of drops that spread into thin films with thicknesses on the order of the boundary layer dimension, the free surface is always observed to vibrate at the capillary-viscous resonance frequency despite the surface vibration frequency being several orders larger. This is contrary to common assumptions used in deriving subharmonic models resulting in a Mathieu equation, which has commonly led to spurious predictions in the droplet size.

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