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A mesoscale study of shear pinch-off MARCO ARIENTI, Sandia National Laboratories, XIAOYI LI, United Technologies Research Center — The dynamic behavior of a liquid thread undergoing thinning and pinch-off under stretching is simulated using Many-body Dissipative Particle Dynamics (MDPD). The mesoscale nature of this method is first verified with the well-known capillary pinch-off dynamics, where the cascade of self-similar regimes – inviscid (2/3 power law), inertial-viscous (linear power law), and stochastic (0.418 power law) – can be fully captured in a single simulation. Computationally, the imposition of axial stretching requires a new boundary treatment because periodicity cannot accommodate opposing motions at the two ends of the liquid thread. A new algorithm implementing multi-component non-periodic boundary conditions (MCNPBC) is shown to enforce a prescribed liquid-gas interface at the boundary while maintaining a constant number density of both components. The first feature makes multi-component particle methods more flexible, since the computational boundaries can cut through the liquid thread; the second is crucial because in MDPD the repulsive interaction is density-dependent. With this boundary treatment, the strain rate due to an outer fluid is introduced as a parameter in the balance of capillary, viscous, and inertial forces leading to pinch-off.

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