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Ejecta from shocked metals: comparative simulations using molecular dynamics and smoothed-particle hydrodynamics SERGEY DYACHKOV, ANATOLY PARSHIKOV, VASILY ZHAKHOVSKY, All-Russia Research Institute of Automatics — The machining of materials produces regular micrometer-sized surface perturbations. The microscopic cumulative jets can be generated from such surface under shock loading. It is a problem to trace space-time evolution of such jets with good enough resolution in experimental conditions. Comparative simulations by molecular dynamics (MD) and smoothed-particle hydrodynamics (SPH) methods, using an equation of state consistent with the employed interatomic potential, can shed of light on details of jet formation. The realistic experimental samples can be directly simulated by SPH method, while the linear size of a MD sample is restricted by the order of 100 nm. To compare the SPH and MD simulations the MD results must to be scaled to micrometer-sized samples. We demonstrate that the scaling provides the similar jet velocity profiles and mass distributions obtained by both methods. Furthermore, the simulated results agree well with the experimental observations with Copper and Tin. The effect of surface tension, which guides evolution of nanoscale-sized jet shape, may lead to discrepancies between MD and SPH simulations, especially for weak shocks and small surface perturbations.

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