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Mass-velocity and size-velocity distributions of ejecta cloud from shock-loaded tin surface using large scale molecular dynamics simulations OLIVIER DURAND, LAURENT SOULARD, CEA — The mass (volume and areal densities) versus velocity as well as the size versus velocity distributions of a shock-induced cloud of particles are investigated using large scale molecular dynamics (MD) simulations. A generic 3D tin crystal with a sinusoidal free surface roughness is set in contact with vacuum and shock-loaded so that it melts directly on shock. At the reflection of the shock wave onto the perturbations of the free surface, 2D sheets/jets of liquid metal are ejected. The simulations show that the distributions may be described by an analytical model based on the propagation of a fragmentation zone, from the tip of the sheets to the free surface, within which the kinetic energy of the atoms decreases as this zone comes closer to the free surface on late times. As this kinetic energy drives (i) the (self-similar) expansion of the zone once it has broken away from the sheet and (ii) the average size of the particles which result from fragmentation in the zone, the ejected mass and the average size of the particles progressively increase in the cloud as fragmentation occurs closer to the free surface. Though relative to nanometric scales, our model reproduces quantitatively experimental profiles and may help in their analysis.

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