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Collapse of a collection of nanovoids in f.c.c. and b.c.c. metals[1]

E.M. BRINGA, C.J. RUESTES, J.R. NIEVA, ICB, UN Cuyo, Argentina, K. OLNEY, D. BENSON, UCSD, USA — Experiments that probe pressure-induced nanovoid collapse at the relevant nanoscopic length and time scales are extremely difficult or impossible with current set-ups, and continuum models might not work at the nanoscale. As a result, atomic-scale simulations can provide unique insights, possible links to models at the micro-scale, and help interpretation of experiments that average over the macroscale. We extend our previous molecular dynamics (MD) simulations of a single nanovoid collapse in both face centered cubic (fcc) and body centered cubic (bcc) metals, to the collapse of a collection of nanovoids. Pre-existing spherical nanovoids, with a radius of 3-4 nm, provide an initial porosity of 5%-20% for the samples studied. For fcc Au, shear loops are nucleated at void surfaces leading to significant softening, followed by Taylor-style hardening above a certain dislocation density. For bcc Ta, full dislocations are nucleated and also lead to significant softening. We examine strain rate effects, from 10^7/s to 10^{10}/s, in the dislocation density and dislocation-induced heating. Comparison with continuum calculations including crystal plasticity will also be presented.

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