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The onset of spallation in nanocrystalline copper: An atomic scale study AVINASH DONGARE, North Carolina State University, Raleigh, NC, ARUNACHALAM RAJENDRAN, University of Mississippi, Olemiss, MI, BRUCE LAMATTINA, U. S. Army Research Office, Research Triangle Park, NC, MOHAMMED ZIKRY, DONALD BRENNER, North Carolina State University, Raleigh, NC — Dynamic failure in nanocrystalline metals can be understood based on the mechanisms of plastic deformation and failure at high strain rates. The bulk of current research on nanocrystalline metals focuses on deformation mechanisms; however, the research on the failure mechanisms (spallation) at high strain rates is still at a stage of the initial exploration. We examine the micro-mechanisms related to dynamic failure of nanocrystalline Cu at high strain rates through a series of large-scale MD simulations. Void nucleation and growth is studied in nanocrystalline copper for conditions of deformation that lead to the onset of spallation during shock loading. The high tensile triaxial stress states result in the nucleation of nanocscale voids at the grain boundaries that grow and coalesce to form the microscopic crack. The effect of shock pressure, strain rates, and grain size on the spall strength and microscopic failure mechanisms as obtained from MD simulations will be discussed. The research is supported by the U. S. Army Research Office through the National Research Council Research Associateship Program.

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