Abstract Submitted
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Void Nucleation and Growth in Shocked Materials K.T. RAMESH, The Johns Hopkins University, Baltimore, MD 21218, T.W. WRIGHT, US Army Research Laboratory, APG, MD 21005, A. MOLINARI, Universite de Metz Ile du Saulcy, Metz 57045 France — Spall fracture and other rapid tensile failures are often dominated by the rapid growth of voids. Recent research on the mechanics of void growth clearly shows that void nucleation may be represented as a bifurcation phenomenon, followed by highly localized plastic flow around the new void. The critical bifurcation stress can be calculated, given the thermomechanical constitutive equation for the material. Nucleation and early growth (limited void volume fraction) have been estimated (Molinari and Wright, JMPS, to appear) by combining the simple dynamical equation for void growth with an assumed distribution for the local critical stress. We extend this to include rate effects in growth and to consider defect distributions in pure polycrystalline metals. A necessary consequence of the defect distribution is the development of loading rate effects (e.g., a higher failure stress is predicted for a higher rate of loading, and a more uniform distribution of smaller voids is developed). Various classes of defects are considered, and the consequences of defect evolution as a result of prior shock loading are investigated.

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