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Influence of complex stress state on spall fracture in high-purity copper XIAOYANG PEI, CHANGMING HU, National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, MEILAN QI, School of science, Wuhan University Technology, HONGLIANG HE, National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, PING LI, State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology — Consideration is given to non-one-dimensional shock wave on damage and spallation of high-purity copper. The creation of damaged regions leading to failure are conducted in gas-gun experiments using a smaller flyer plate (diameter $\sim$ 50mm) impacting a larger target plate (diameter $\sim$ 100mm). Because of the edge rarefaction effect, non-planer waves originating from the circumferential edge complicate the pattern of wave deformation. A multi-Doppler Pin Systems (DPS) were used to detect the free surface velocities of variable points. The damage and post-shock microstructures of the soft recovered samples were characterized using metallogenetic microscopy. The experiments were simulated with a two-dimensional finite-element calculations employing a damage function model. The peak stress, peak tensile stress and wave shape of different radial locations are determined by the comparisons of experiment and simulation results of free surface velocity profiles. Damage evolution processes and localized behavior of different locations in sample were studied. It was concluded that the shock-wave profile shape and the stress/strain state both strongly affect the spall properties and damage distributions.

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