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1-D Continuum and 2-D Mesoscale Simulations of Plate Impact Spall Experiments S.K. DWIVEDI, X.L. CHEN, J.R. ASAY, Y.M. GUPTA, Institute for Shock Physics, Washington State University — 1-D simulations using a continuum fracture model show good agreement of the calculated spall threshold stress and pull-back velocity profiles with plate impact spall data on Al alloys. The calculated mode I critical strain energy release rate, or fracture toughness, was observed to increase over the impact stress range of 4-13 GPa and decreased for higher stresses. The model did not predict a change in slope of the pullback velocity profile observed in several experiments. In contrast, 2-D mesoscale simulations of thinner sample using grain boundary debonding as the failure phenomenon also resulted in free surface profiles similar to that measured experimentally. These simulations showed the observed change in slope, heterogeneous spall planes, and a strong dependence of the velocity profile on mesoscale heterogeneities modeled in terms of grain-to-grain property variation, micro-voids, inclusions, and hardened grain boundaries. The change in the slope of the pull back velocity appears to result from attenuation and dispersion of stress waves produced by secondary spall planes. Work supported by DOE.

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