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Effect of shock wave duration on dynamic failure of Tungsten Heavy Alloy CARL P. TRUJILLO, E. PABLO ESCOBEDO, ERIC N. BROWN, ELLEN K. CERRETA, GEORGE T. GRAY, Los Alamos National Laboratory — It has been well established that dynamic fracture or spall is a complex process strongly influenced by both microstructure and the loading profile imparted to the specimen. Having previously considered ductile materials with damage and deformation kinetics that are slow relative to the shock wave, here we consider a brittle material with damage and deformation kinetics that are fast relative to the shock wave. The present study elucidates the effect of loading profile on the fundamental mechanisms of brittle fracture in brittle tungsten heavy alloy (WHA) specimens. Spall experiments are performed on with two significantly distinct shock pulse durations and accompanying unloading rates. Detailed fractographic analyses of the damage in the spalled WHA samples as a function of shock-wave profile of comparable peak stress is presented. For both profiles, it is observed that the failure in WHA is by brittle trans-particle crack growth with additional energy dissipation through crack branching in the more brittle tungsten particles. We also observe that for the 15.4 GPa peak shock stress, the wave profile does not influence the spall strength significantly. This is believed to be directly linked with the relative insensitivity of WHA to time dependent processes.

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