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Gas Gun Driven Dynamic Fracture and Fragmentation of Ti-6Al-4V Cylinders at Initial Temperatures Between 150K and 750K DAVID R. JONES, DAVID J. CHAPMAN, DANIEL E. EAKINS, Institute of Shock Physics, Imperial College London — We present a study of dynamic fracture and fragmentation in Ti-6Al-4V cylinders at initial temperatures ranging from 150 K to 750 K. Samples with inner diameter of 50 mm and wall thickness of 4 mm were driven into uniform axially-symmetric expansion at radial strain rates of 10^4 s^{-1} using the ogive-insert gas gun method. Experiments were highly diagnosed, employing a combination of high speed imaging, PDV and fragment recovery. Imaging and PDV provided a record of expansion velocity and failure strain. Recovered fragments were examined with optical, SEM and EBSD techniques to determine the fracture mechanisms occurring for each initial temperature. The failure strain was observed to increase with temperature over the range tested, from 7.4±5.2 percent at 158 K to 24.1±2.4 percent at 750 K. In experiments from 158 K up to 609 K the fracture mechanism was found to be ductile tearing under mode II loading, along the planes of maximum shear at 45° to the radius. At an initial cylinder temperature of 724 K the fracture mechanism transferred to void nucleation and coalescence along adiabatic shear bands, again oriented at 45°. The fragmentation toughness was largely independent of temperature with an average value of 101±13 MPa $m^{-1/2}$.

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