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Gas Gun Driven Dynamic Fracture and Fragmentation of Ti-6Al-4V DAVID JONES, DAVID CHAPMAN, DANIEL EAKINS, Institute of Shock Physics, Imperial College London — The dynamic fracture and fragmentation of a material is a complex late stage phenomenon occurring in many shock loading scenarios. Improving our predictive capability depends upon exercising our current failure models against new loading schemes and data. We present a series of experiments creating axially symmetric high strain rate (10^4 s^{-1}) expansion of Ti-6Al-4V cylinders under controlled loading achieved using the ogive based gas gun technique. A steel ogive is located inside the cylinder, into which a polymer rod is launched. Deformation of the rod around the insert drives the cylinder into rapid expansion. This technique facilitates repeatable loading independent of the sample temperature and straightforward adjustment of radial strain rate. Expansion velocity was measured at multiple points along the cylinder outer wall using PDV. Two high speed imaging systems are used to track the overall expansion process to record strain at failure. Optical and SEM imaging is used to measure fragment size and mass distributions and examine the fracture surfaces to reveal the failure mechanism. For a peak radial strain rate of (1.1 ± 0.1) x 10^4 s^{-1} strain localisation initiates on the outer surface at a radial strain of around 12%, with cracks fully penetrating the cylinder wall at around 22%. Hydrocode modelling has been completed with very strong agreement in predicting the expansion velocity and profile but further work is needed to develop an accurate representation of the fracture and fragmentation.

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