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The fracture and fragmentation behaviour of additively manufactured stainless steel 316L RUSSELL AMOTT, ERNEST HARRIS, RON WINTER, STEWART STIRK, AWE, Aldermaston, DAVID CHAPMAN, DANIEL EAKINS, Imperial College London — Expanding cylinder experiments using a gas gun technique allow investigations into the ductility of metals and the fracture and fragmentation mechanisms that occur during rapid tensile failure. These experiments allow the radial strain-rate of the expansion to be varied in the range 102 to 104 s-1. Presented here is a comparative study of the fracture and fragmentation behaviour of rapidly expanded stainless steel 316L cylinders manufactured from either wrought bar or by additive manufacturing techniques. The results show that in the strain-rate regime studied, an additively manufactured cylinder failed at a higher strain and produced larger fragment widths compared to cylinders manufactured from wrought bar. In addition, an investigation into the role of deliberate equispaced macroscopic voids introduced into a cylinder wall has been undertaken. Using the unique properties of additive manufacture, elongated voids were introduced to the cylinder wall at an angle of 45° to the cylinder radius, and the resulting fragment patterns will be discussed. A comparison of the expanding cylinder profiles with simulations using CTH will also be presented.

Russell Amott
AWE, Aldermaston

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