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A Relation for Fragment Sizes of Explosive Loaded Aluminum Cylinders J. LEADBETTER, L. DONAHUE, R.C. RIPLEY, Martec Ltd., F. ZHANG, Defence Research and Development Canada - Suffield — It is well established that the fragment size from explosively-loaded metal cylinders can be related to the expansion rate driven by high pressure explosive detonation products. During expansion, high strain rates alter material properties, and failure mechanisms influencing fragment size distribution become dependent on dynamic phenomena such as localized shear banding. The purpose of this paper is to extend known relations for steel fragment size to aluminum cylinders. The present approach utilizes high strain rate properties of aluminum with Grady and Kipp dynamic fragmentation theory to determine mean fragment size, and a statistical fragment distribution to account for randomness in the aluminum cylinder material. To determine the expansion strain rate, the explosive detonation and cylinder expansion are modeled using a two-way coupled fluid structure interaction routine. Experimental results for an aluminum-cased C4 charge are provided for model validation. Further analysis of a series of modeling results is shown to establish relationships for aluminum fragment size as a function of detonation pressure and the metal to explosive mass ratio.

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