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Controlled Detonation Dynamics in Additively Manufactured High Explosives[1] ANDREW SCHMALZER, BRYCE TAPPAN, PATRICK BOWDEN, VIRGINIA MANNER, BRAD CLEMENTS, RALPH MENIKOFF, AXINTE IONITA, BRITTANY BRANCH, DANA DATTELBAUM, MICHELLE ESPY, BRIAN PATTERSON, RUILIAN WU, ALEXANDER MUELLER, Los Alamos National Laboratory — The effect of structure in explosives has long been a subject of interest to explosives engineers and scientists. Through structure, detonation dynamics in explosives can be manipulated, introducing a new level of safety and directed performance into these previously difficult to control materials. New advances in additive manufacturing (AM) allow the deliberate introduction of exact internal structures at dimensions approaching the mesoscale of these energetic materials. We show through simulation and experiment that this structure can be used to control detonation behavior by manipulating complex shockwave interactions. We use high-speed video and shorting mag-wires to determine the detonation velocity in AM generated explosive structures, demonstrating, for the first time, a method of controlling the directional propagation of reactive flow through the controlled introduction of structure within a high explosive. With ongoing improvement in the AM methods available coupled with guidance through modeling and simulations, more complex interactions are being explored.

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