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Detonation Wave Manipulation via Inert 3D Printed Open Cell Siloxane Lattices Backfilled with a Liquid Explosive ANDREW SCHMALZER, BRYCE TAPPAN, PATRICK BOWDEN, JOSEPH LICHTHARDT, ALEX MUELLER, RALPH MENIKOFF, Los Alamos National Laboratory — Additive manufacturing (AM) has generated recent interest in the field of energetic materials and shock physics by generating structural methods to manipulate the dynamic behavior of materials. X-ray phase contrast imaging studies of the shock response of Direct Ink Write AM siloxane lattices has shown that by slightly varying structure, while maintaining other geometric constraints (extrudate size, bulk density, etc...), the material response to a transiting shock can be manipulated from jet-like extrusion to a sinusoidal crush-up response, in comparison to the planar wave associated with stochastic foams. Previous studies of AM using high explosive (HE) feedstocks has explored the anisotropic sensitivity of strand structured explosives by using internal structure as guides for weak precursor shocks that can travel at rates (~12 km/s), much faster than the bulk HE detonation velocity (~8 km/s) leading to pre-shock desensitization. In this work, we investigate simple cubic and face centered tetragonal siloxane lattices backfilled with the liquid explosives nitromethane or trimethylolethane trinitrate using back-lit high speed imaging techniques. Using this technique, density gradients are easily programmed into inert printed structures, thus altering the local detonation wave velocity in the liquid explosives.

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