Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Time-resolved Sensing of Shock Pressure Distributions Using OPTO-Mechanical Multi-layer Photonic Crystal Structures[1] NARESH THADHANI, DAVID SCRIPKA, ANDREW BODDORFF, GREG KENNEDY, Georgia Institute of Technology — We are investigating the design and application of optomechanical sensors based on a *Distributed Bragg Reflector (DBR)* composed of dielectric stacks of alternating high and low refractive index materials, and an *Optical Micro Cavity (OMC)* composed of a dielectric cavity-layer placed between two metal mirrors. These 1-D photonic crystal structures generate size-tunable characteristic spectral changes observed as reflectance peak (for DBRs), or minima (for OMCs) as a function of pressure. Unlike commonly utilized piezoresistive/piezoelectric stress sensors, which provide volume-averaged responses, optomechanical sensors can provide mapping of spatially and temporally resolved pressures, and their distributions across a shocked surface. In this presentation, responses obtained by directly subjecting the DBR (~5 m thick) and OMC (~1 m thick) structures to homogeneous and heterogeneous pressures, using laser-driven shocks and time-resolved spectroscopy enabled by spectrograph-coupled streak camera, will be described, along with results of optomechanical simulations utilizing a custom multi-physics framework. The results reveal a highly time-resolved spectral response to shock loading manifesting as wavelength shifts as a function of pressure, which correlate well with simulations. The ability to capture pressure distributions with micro-scale spatial variations is also demonstrated for particulate materials.

[1]This project is supported by DTRA grantHDTRA1-18-1-0004

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Date submitted: 26 Feb 2019 Electronic form version 1.4