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Quantum dots as optomechanical sensors for mesoscale time-resolved probing of pressure during shock-compression of heterogeneous materials[1] KARLA WAGNER, GILL BIESOLD-MCGEE, GREG KENNEDY, Georgia Institute of Technology, DIDIER MONTAIGNE, Defense Threat Reduction Agency (DTRA), ZHITAO KANG, ZHIQUN LIN, NARESH THADHANI, Georgia Institute of Technology — We are exploring quantum dots (QDs) as optomechanical sensors for mesoscale time-resolved sensing of pressure during shock-compression of heterogeneous materials. QDs are nanoscale semiconductors with size-dependent characteristic emission associated with band gap energy changes due to quantum confinement effects. Our past work (Kang et al., 2016) shows that QDs exhibit unique optical properties under shock compression, and show spectral intensity change and blueshift that scale with pressure. In the present work, various QDs (e.g. lead halide perovskite, gradient composition) are investigated to determine their response to shock-compression. QDs suspended in a polymer matrix are shock-compressed using a 3J Nd-YAG laser, while a UV laser excites the QDs. The time-resolved shifts in the photoemission of the QDs due to band-gap increase associated with compression is monitored by a streak camera and correlated with simultaneous measurements of particle velocity using Photon Doppler Velocimetry. The goal is to identify and calibrate the response of the various QDs used to record heterogeneous pressures. Results obtained to date will be presented. This project is funded by DTRA grant HDTRA-18-1-004.

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