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Scattering of Gigahertz Coherent Acoustic Phonons by Nanoporous Structures in Hypersonic Crystals GAOHUA ZHU, Toyota Research Institute of North America, GARY WIEDERRECHT, Argonne National Laboratory, SONGTAO WU, DEBASISH BANERJEE, Toyota Research Institute of North America, KAZUHISA YANO, Toyota Central R&D Labs. Inc, TOYOTA TEAM, ARGONNE NATIONAL LABORATORY COLLABORATION, TOYOTA CENTRAL R&D LABS TEAM — A gigahertz acousto-optic modulation technique, based on a mechanism in which the perturbation of the photonic band gap is caused by the coherent oscillation of the phonon modes in the hypersonic crystal, is demonstrated. We present the measurement results of the coherent acoustic vibrations of the hypersonic crystals comprised of SiO_2 or nanoporous SiO_2 spheres. Our transient reflection spectroscopy results identify the different transport behaviors of acoustic waves in the hypersonic crystals. While the bulk phonon waves are heavily damped by the nanoporous structures in the hypersonic crystal, the decay time of the surface phonon wave is barely affected.

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