Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Molding Phonon Flow with Symmetry: Rational Design of Hypersonic Phononic Crystals CHEONG YANG KOH, EDWIN L. THOMAS, Dept of Materials Science & Engineering, Massachusetts Institute of Technology —

Phononic crystals structured at appropriate length scales allow control over the flow of phonons, leading to new possibilities in applications such as heat-management, sound isolation and even energy transfer and conversion. Symmetry provides a unified framework for the interpretation 1D to 3D phononic band structures, allowing utilization of a common set of principles for designing band structures of phononic crystals as well as actual purposeful defects such as waveguide location and boundary termination in finite devices. In this work, we explore the band structure properties of phononic crystals with non-symmorphic space groups, as well as those having quasi-crystalline approximants. We demonstrate gap opening abilities from both anti-crossing and Bragg scattering, as well as unique features like "sticking" bands. Symmetry concepts are also powerful means to tune the density of states of the structures. Importantly, we fabricate various theoretical designs and measure their experimental dispersion diagrams for comparison with theoretical calculation. This affords an elegant approach toward a design blueprint for fabricating phononic structures for applications such as opto-acoustic coupling.

Cheong Yang Koh
Dept of Materials Science & Engineering,
Massachusetts Institute of Technology

Date submitted: 13 Nov 2008 Electronic form version 1.4