Integrating Nanotechnology with Cell Biology and Neuroscience

INCBN IGERT Seminar

Monday, 17 Oct. 2011, 2:30 pm

Speaker:

Zayd C. Leseman
Associate Professor, Dept. of Mechanical Engineering, UNM

Manipulation of Phonons Using Phononic Crystals: Theory, Fabrication, and Characterization

Phononic crystals (PnCs) are a periodic arrangement of scattering centers in a homogenous background matrix. The PnC’s lattice spacing is on the order of the wavelength the PnC is to manipulate. Overlapping of Bragg and Mie resonances inhibits the propagation of elastic waves over a broad range of frequencies. For frequencies on the order of a GHz (microscale dimensions and larger), PnCs can be used to design high quality factor resonators and phononic logic. At frequencies of 1 GHz and higher (micro and nanoscale dimensions), PnCs cause a redistribution of the phononic density of states, which will alter the thermal conductivity of a material. In this talk, we will examine the behavior of PnCs using continuum mechanics coupled with a plane wave expansion analysis. With this motivation, we will examine PnCs that our group has fabricated with frequencies ranging from 1 GHz to 35 GHz. Recently, we have made measurements on PnCs constructed from Si with air holes, which display thermal conductivities as low as 6.8 Wm⁻¹K⁻¹. Measured PnC values are more than an order of magnitude lower than that of bulk Si, 148 Wm⁻¹K⁻¹.