512. Title:Strong coupling between nanoscale metamaterials and phonons
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Abstract:We use split ring resonators (SRRs) at optical frequencies to study strong coupling between planar metamaterials and phonon vibrations in nanometer-scale dielectric layers. A series of SRR metamaterials were fabricated on a semiconductor wafer with a thin intervening SiO2 dielectric layer. The dimensions of the SRRs were varied to tune the fundamental metamaterial resonance across the infrared (IR) active phonon band of SiO2 at 130 meV (31 THz). Strong anticrossing of these resonances was observed, indicative of strong coupling between metamaterial and phonon excitations. This coupling is very general and can occur with any electrically polarizable resonance including phonon vibrations in other thin film materials and semiconductor band-to-band transitions in the near to far IR. These effects may be exploited to reduce loss and to create unique spectral features that are not possible with metamaterials alone. © 2011 American Chemical Society.