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Raman spectroscopic investigation of the confined optical phonon modes in the aligned CdSe nanorod arrays CONCETTA NOBILE, LUIGI CARBONE, STEFAN KUDERA, LIBERATO MANNA, ROBERTO CINGOLANI, ROMAN KRAHNE, National Nanotechnology Laboratory, VLADIMIR A. FONOBEROV, ALEXANDER A. BALANDIN, University of California - Riverside, GERWIN CHILLA, TOBIAS KIPP, DETLEF HEITMANN, University of Hamburg — Nanocrystal rods have emerged as promising nanostructured material for both fundamental studies of nanoscale effects and for optical and electronic device applications. We investigated the optical phonon excitations in laterally aligned CdSe nanocrystal rod arrays using resonant Raman scattering. Electric-field mediated alignment between interdigitated electrodes has been used to prepare the samples. We report Raman experiments that probe the optical lattice vibrations in ordered arrays of CdSe nanorods with respect to the nanorod orientation. The packing of nanorods into dense arrays leads to the suppression of the surface optical phonon modes. In the longitudinal-optical phonon peak we observe a fine structure that depends on the relative orientation of the nanorods with respect to the incident light polarization. Detailed comparison of the experimental data with the first-principle calculations for corresponding nanostructures, which reveal the symmetry of the phonon potentials for the Raman active modes, provides a qualitative explanation of the experimentally observed phonon modes.

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