2006 Vol.46 No.6 pp.1109-1112 DOI:

Interface-Optical-Phonon Modes in Quasi-one-dimensional Wurtzite Rectangular Quantum Wires

ZHANG Li

Department of Mechanism and Electron, Panyu Polytechnic, Panyu 511483, China
(Received: 2006-2-6; Revised: 2006-5-17)

Abstract: By employing the dielectric continuum model and Loudon's uniaxial crystal model, the interface optical (IO) phonon modes in a freestanding quasi-one-dimensional (Q1D) wurtzite rectangular quantum wire are derived and analyzed. Numerical calculation on a freestanding wurtzite GaN quantum wire is performed. The results reveal that the dispersion frequencies of IO modes sensitively depend on the geometric structures of the Q1D wurtzite rectangular quantum wires, the free wave-number k_z in z-direction and the dielectric constant of the nonpolar matrix. The degenerating behavior of the IO modes in Q1D wurtzite rectangular quantum wire has been clearly observed in the case of small wave-number k_z and large ratio of length to width of the rectangular crossing profile. The limited frequency behaviors of IO modes have been analyzed deeply, and detailed comparisons with those in wurtzite planar quantum wells and cylindrical quantum wires are also done. The present theories can be looked on as a generalization of that in isotropic rectangular quantum wires, and it can naturally reduce to the case of Q1D isotropic quantum wires once the anisotropy of the wurtzite material is ignored.

PACS: 78.67.Lt, 63.20.Kr, 81.05.Ea
Key words: interface phonon modes, polarization eigenvectors, rectangular quantum wire

[Full text: PDF]

Close