2007 Vol.47 No.2 pp.349-354 DOI:

Vibration Spectra of Quasi-confined Optical Phonon Modes in an Asymmetric Wurtzite $Al_xGa_{1-x}N/GaN/Al_yGa_{1-y}N$ Quantum Well

ZHANG Li[1,2] and SHI Jun-Jie[1]

[1] State Key Laboratory for Mesoscopic Physics and School of Physics, Peking University, Beijing 100871, China

[2] Department of Mechanics and Electronics, Panyu Polytechnic, Panyu 511483, China

(Received: 2006-3-6; Revised: 2006-4-26)

Abstract: Based on the dielectric continuum model and Loudon's uniaxial crystal model, the properties of the quasi-confined (QC) optical phonon dispersions and the electron-QC phonons coupling functions in an asymmetric wurtzite quantum well (QW) are deduced via the method of electrostatic potential expanding. The present theoretical scheme can naturally reduce to the results in symmetric wurtzite QW once a set of symmetric structural parameters are chosen. Numerical calculations on an asymmetric $AlN/GaN/Al_{0.15}Ga_{0.85}N$ wurtzite QW are performed. A detailed comparison with the symmetric wurtzite QW was also performed. The results show that the structural asymmetry of wurtzite QW changes greatly the dispersion frequencies and the electrostatic potential distributions of the QC optical phonon modes.

PACS: 78.67.De, 63.20.Dj, 74.25.Kc

Key words: quasi-confined optical phonon, asymmetric wurtzite QW, nitride-based semiconductor

[Full text: PDF]

Close