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Quantum conductance of carbon nanotube at finite temperature: effect of electron-phonon interactions NARJES GORJIZADEH, Tohoku University, AMIR A. FARAJIAN, Wright State University, YOSHIYUKI KAWAZOE, Tohoku University — Effect of inelastic electron-phonon interaction is studied on electronic transport of semiconducting carbon chains and carbon nanotubes. Absorption and emission of individual phonon modes are investigated as well as collective modes in order to reveal the nature of the interactions and the role of vibrations in quantum transport at finite temperature. The conductance in this study is calculated using non-equilibrium Green's function formalism combined with a tight-binding Hamiltonian description. The phonon spectrum is obtained from frozen-phonon approach and the electron-phonon interaction appears in the calculations as a coupling matrix determined by atomic displacements and phonon eigenvectors. Our results show that the effect of individual electron-phonon interaction on quantum conductance depends on temperature and energy of the phonon mode, regarding absorption and emission processes. The type of the phonon mode is in fact a determining part of the interactions. Decrease of conductance due to e-ph scattering is stronger when the process is scattering of electron out of in-plane phonons which make the in-plane C-C bonds of nanotube or chain vibrate with higher length. The effect of collective modes also suggests the temperature dependent nature of the conductance of a finite size carbon chain and nanotube.

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