VIBRATION SPECTRUM AND ELECTRON - PHONON SCATTERING IN SEMICONDUCTOR NANOTUBES

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We consider semiconductor A3B5 nanotubes made by scrolling up an appropriate quantum well. The eigen modes of the vibrations of such a hollow cylinder are found with accounting for the cubic symmetry of the crystall and piezoelectric contribution to the equations of the elasticity theory. The vibration modes are characterized by the azimuthal quantum number N = 1,2,3,.. Depending on N and polarization we obtain both gapless modes and the modes with gaps of the order of s/R, where s is the speed of sound, R is the tube radius. The most interesting seems the mode N=1 of mixed polarization (azimuthal and radial) which has no gap and its frequency in the long wavelength limit is proportional to the wave vector squared. In the contrast with the corresponding waves in thin plates (also having the quadratic dispersion law) the found here mode does not depend on the thickness of the nanotube wall when the latter tends to zero.. At! low temperatures $T \ll hs/R$ just this mode predominates in thermodynamic and kinetic properties of the nanotube.

In the magnetic field parallel to the tube axis the magnetoresistance oscillates as a function of magnetic flux through the tube with the period h/e.