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Radial hetero structured GaAs/AlGaAs nanowires (NW)

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Photoluminescence was studied in GaAs/AlGaAs NWs with different radial hetero structures. We demonstrated that manipulation of the emission energy may be achieved by appropriate choice of the shell structure. Structural characterization of the nanowires (NW) was performed with transmittance electron microscopy, photoluminescence and Raman scattering measurements, which unambiguously manifested to the presence of segments crystallized in zinc-blende and wurtzite phases. Four observed photoluminescence lines are assigned to the radiative recombination of photo excited electrons confined in the centre of the GaAs core and at the heteroboundary between the outer GaAs shell and the inner AlGaAs one with the holes localized at the hetero boundary between the core and the inner AlGaAs shell; both recombination take place in zinc-blende as well as in wurtzite phases. One additional photoluminescence line is attributed to the spatially indirect recombination between the electrons in zinc-blende and the holes in wurtzite phases. A simple model based on representation of the valence band structure using two levels, accounts well for the observed temperature dependence of the integrated photoluminescence intensities. A red shift of the recombination time maximum with respect to the photoluminescence peak energy was demonstrated in doped NWs. The proposed double shell structure with tunnelling transparent inner shell sets conditions for easy control of the emission energy of the hetero structured NWs. The results of this study are published. In addition, time-resolved photoluminescence is employed to study electron-hole dynamics.

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