TEMPERATURE DEPENDENCE OF THE EXCITONIC TRANSITION ENERGY IN FLAT SEMICONDUCTOR NANOFILMS

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S u m m a r y

The Green's function method has been applied to study the temperature dependence of the exciton ground state energy in a flat semiconductor nanofilm. The binding energy of an exciton and its temperature dependence have been evaluated within the Bethe method. Numerical calculations were carried out in the framework of the finite-depth rectangular quantum well model, by considering flat nanofilms on the basis of double heterojunctions β-HgS/β-CdS and GaAS/$\mathrm{Al}_x\mathrm{Ga}_{1-x}\mathrm{As}$ as examples. The exciton binding energy in the studied nanosystems with weak electron-phonon coupling was found to be practically independent of the temperature T. The energy of the excitonic transition into the ground state decreases nonlinearly with increase of T owing to the renormalization of the charge carrier energy by the electron-phonon interaction. The rate of temperature-induced exciton energy change depends on the nanofilm thickness a, being the largest at $a \leq 10 \div 25$ nm.