

Regular Papers

Section I

Dielectric materials for electronics and photonics

Invited Papers

Phonon-Plasmonic Bipolaronic Superconductivity in the FeSe/SrTiO₃ Quantum Structure

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Abstract: The bipolaron mechanism of experimentally observed high-temperature superconductivity (HTSC) in FeSe monolayers on massive SrTiO₃ substrates [1] has been theoretically investigated, based on the exact Hamiltonian of the electron-phonon interaction for multilayer structures [2]. Bipolaronic states arise in FeSe quantum layers due to the interaction of electrons with the electric field of Fuchs-Kliwer surface optical phonons [3] of the strongly polar semiconductor SrTiO₃ penetrating into the FeSe monolayer. The effect of doping of a crystalline SrTiO₃ substrate with n-type niobium impurities on the critical temperature T_c of HTSC in a monolayer of FeSe is considered. The role of surface polaron plasmons formed in SrTiO₃ upon contact with the FeSe quantum layer during the interaction of impurity electrons with surface optical phonons of SrTiO₃ is investigated. It is shown that electrons in the quasi-two-dimensional FeSe layer induce an additional polarization potential in the SrTiO₃ substrate, which increases the binding energy of bipolarons in the FeSe layer, which leads to an increase in the critical temperature of bipolaronic superconductivity.

Keywords: phonons, plasmons, bipolarons, multilayer structures, high-temperature superconductivity

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