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The boundary influence upon superconducting properties of high T_c superconductors

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The properties of superconducting plates with a thickness of the coherence length were investigated by numerically solving the system of one-dimensional Ginzburg-Landau-Gor'kov (GLG) equations. The new boundary condition is applied to the case of CuO_2 planes which are the main structural elements responsible for superconductivity in high T_c superconductors. Spatial dependence of the pairing potential across the thickness of the superconducting CuO_2 planes in HTSC copper oxides is found by using the GLG theory. The potential turned out to be significantly suppressed due to an effect of non-superconducting layers, which separate the CuO_2 planes. The temperature dependence of the effective energy gap was calculated in this work. The bulk interaction potential in the cuprate HTSC is estimated within the framework of BCS theory. The large value of the potential indicates the presence of a strong coupling interaction of the electrons in Cooper pairs. The effect leads also to the reduction of the critical temperature of these superconductors. So that, the number of CuO_2 planes that are within a short distance of each other in a unit cell should be increased for increasing T_c of the cuprate superconductors. The influence of boundary conditions in Ginzburg-Landau theory on the critical state of superconducting layered structures was studied also in the work by using a new method for calculating the dependence of the critical current on the applied magnetic field. It has been shown that taking into account the influence of the boundary in the calculations leads to a better agreement with experimental data.

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