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Two-dimensional superconductivity with broken inversion symmetry in one-atomic-layer metal films on cleaved GaAs surfaces TAKAYUKI SEKIHARA, TAKAHIRO MIYAKE, HIROKI ICHINOMIYA, RYUICHI MASUTOMI, TOHRU OKAMOTO, Univ of Tokyo — We have studied the parallel-magnetic-field dependence of the superconducting transition temperature T_c by magnetotransport measurements on one-atomic-layer Pb and indium films deposited on cleaved GaAs surfaces. Superconductivity was stable even in parallel magnetic field $H_{\parallel}$ much higher than Pauli paramagnetic limit. Especially the reduction of the transition temperature in the Pb films was found to be rather small even in $H_{\parallel}$ up to 14 T. Furthermore, the perpendicular magnetic field dependence of the sheet resistance in the Pb films was almost independent of the presence of the parallel field component. For the case of the Pb films, the observed parabolic $H_{\parallel}$ dependence of T_c is quantitatively explained in terms of an inhomogeneous superconducting state, called a helical state, theoretically proposed for a two-dimensional superconductor with a large Rashba spin splitting $\Delta_R \gg \hbar\tau^{-1}$. For the case of the indium films, we developed the theory for a moderate Rashba spin splitting. The values of Δ_R are estimated to be 0.04 eV, which is one order of magnitude smaller than that expected for the one-atomic-layer Pb films.

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