

Two-Dimensional Electron Gas (2DEG) at Ta₂O₅ / SrTiO₃ Heterointerface

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Two-dimensional electron gas (2DEG) has been investigated at the heterointerface between two insulating dielectric perovskite oxides, LaAlO₃ (LAO) / SrTiO₃ (STO). Properties of the 2DEG have attracted an enormous interest in condensed matter physics due to multifunctional properties such as the coexistence of ferromagnetism and superconductivity, as well as the high electron mobility. Here, we have grown Ta₂O₅ thin films using pulsed laser deposition on SrTiO₃ substrate to investigate the electric properties of the Ta₂O₅ / STO heterointerface. Our research reveal that the non-polar Ta₂O₅ / TiO₂ heterointerface favors the formation of 2DEG similar to that at the LAO / STO heterointerface. The metallic behavior was found in this heterointerface with the current about 10~100 μ A at 5 V by using conventional I-V measurements, when the Ta₂O₅ film thickness reaches over critical thickness, $d_c \simeq 2uc$. The finding that electrons was localized at Ta₂O₅ / STO heterointerface have attracted to be strong and new candidate for nanoscale oxide device applications.

Keywords: 2DEG, Oxide heterointerface, Perovskite structure