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Transport and band profiles of MBE grown $LaAlO_3$/ $SrTiO_3$
YARON SEGAL, J.H. NGAI, J.W. REINER, F.J. WALKER, C.H. AHN, Department of Appiled Physics and Center for Research on Interface Structures and Phenomena, Yale University — Previously reported properties of the $LaAlO_3/SrTiO_3$ system showed strong dependence on growth parameters. This makes it difficult to identify the key physical quantities. To isolate the role of oxygen content, we grew $LaAlO_3$ films on $SrTiO_3$ using MBE. The thermal evaporation of MBE minimizes potential damage to the substrate and interface. The samples were then annealed at low temperature for a prolonged time, thus raising the oxygen content without damaging the structural integrity of the film. Transport and X-ray photoemission measurements were performed before and after annealing on films grown on both terminations of the substrate. Transport measurements show the in-plane conductivity decreases by several orders of magnitude upon annealing. A dependence on film thickness appears in certain oxygen content regimes, where it can be interpreted as being controlled by oxygen diffusion. Photoemission measurements reveal an intriguing band structure in the $LaAlO_3$ film. The termination of the $SrTiO_3$ determines the direction of apparent band bending, for which we discuss possible models. Our results imply that while transport behavior of this system is dominated by oxygen diffusion, the atomic details of the interface have a substantial impact on band structure.

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