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Effect of stoichiometry on the $LaAlO_3/SrTiO_3$ 2-D electron gas grown by MBE M.P. WARUSAWITHANA, A.A. PAWLICKI, Department of Physics and NHMFL, Florida State University, T. HEEG, D.G. SCHLOM, Department of Materials Science and Engineering, Cornell University, C. RICHTER, S. PAETEL, J. MANNHART, Experimentalphysik VI, University of Augsburg, M. ZHENG, B. MULCAHY, J.N. ECKSTEIN, Department of Physics, University of Illinois at Urbana-Champaign, W. ZANDER, J. SCHUBERT, Inst. of Bio and Nanosystems IBN1-IT and JARA-FIT, Research Centre Jülich — We find that through careful control of the stoichiometry in molecular-beam epitaxy grown $LaAlO_3/SrTiO_3$ samples, a 2-dimensional electron gas occurs at the interface between the two insulating oxides as extensively reported in samples grown by pulsed-laser deposition. Our results eliminate many extrinsic effects suggested as possible mechanisms of conductivity and are consistent with the polar catastrophe mechanism being responsible for the conductivity in our MBE-grown samples. We further show that the cation stoichiometry of the $LaAlO_3$ layer is key to the existence of the 2-dimensional electron gas and that a La/Al ratio less than or equal to 0.97 ± 0.03 is a necessary condition to obtain a conducting interface in this system.

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