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Effect of stoichiometry on the interface conductivity of MBE-grown $LaAlO_3/SrTiO_3$ heterostructures M.P. WARUSAWITHANA, J. LUDWIG, P. ROY, 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, L. FITTING KOURKOUTIS, J. MUNDY, D.A. MULLER, School of Applied and Engineering Physics, Cornell University, 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 — Through careful control of the stoichiometry in molecular-beam epitaxy grown $LaAlO_3/SrTiO_3$ samples, we find that a 2-dimensional electron gas occurs at the interface between the two insulating oxides as reported in samples grown by pulsed-laser deposition. In this talk, I will discuss the controlled experiments that we have carried out, which effectively eliminate the extrinsic effects that have been suggested as possible mechanisms of conductivity, for the conductivity observed in our MBE-grown samples. We find that the cation stoichiometry of the $La_{(1-x)}Al_{(1+x)}O_3$ layer is key to the existence of the interface 2-dimensional electron gas and that a La/Al ratio, (1-x)/(1+x) less than or equal to 0.97 $\pm$ 0.03 is a necessary condition to obtain a conducting interface in this system.

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