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Polarization effects and the source of electrons in two-dimensional electron gas at insulating oxide heterointerfaces H.W. JANG, D.A. FELKER, C.M. FOLKMAN, D.L. PROFITT, S.H. BAEK, M.S. RZCHOWSKI, C.B. EOM, University of Wisconsin-Madison, K. JANICKA, Y. WANG, M.K. NIRANJAN, E.Y. TSYMBAL, University of Nebraska-Lincoln — The discovery of a two-dimensional electron gas (2DEG) at the heterointerface between insulating perovskite oxides $LaAlO_3$ and $SrTiO_3$ has stimulated intensive theoretical and experimental studies on the origin of the 2DEG. Empirically, the electron density has been found to be strongly dependent on the oxygen partial pressure during growth and the thickness of the polar $LaAlO_3$ layer. Understanding and controlling the source of the electrons in 2DEGs at oxide heterointerfaces is important for the optimization of their performance. In this talk, we will discuss electrical properties of heterointerfaces between various polar perovskites and $SrTiO_3$ fabricated by pulsed laser ablation. The importance of built-in electric fields due to polarization-induced charges, bandgap energy, and oxygen vacancies in the polar layers is highlighted using a simple analysis based on electrostatics. The experimental Hall data are then compared with the theoretical result from first-principles calculations.

Ho Won Jang
University of Wisconsin-Madison

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