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Metal-insulator transition by rare-earth substitution in oxide two-dimensional electron gas D. A. FELKER, H. W. JANG, Univ of Wisconsin, K. JANICKA, Univ of Nebraska, C. T. NELSON, Y. ZHANG, Univ of Michigan, D. SU, Brookhaven National Laboratory, C. M. FOLKMAN, C. W. BARK, S. H. BAEK, S. LEE, Univ of Wisconsin, D. D. FONG, Argonne National Laboratory, Y. ZHU, Brookhaven National Laboratory, X. Q. PAN, Univ of Michigan, E. Y. TSYMBAL, Univ of Nebraska, M. S. RZCHOWSKI, C. B. EOM, Univ of Wisconsin — The effect of rare-earth (R) ion in the formation of a two-dimensional electron gas (2DEG) in epitaxial $SrTiO_3$/RO/$SrTiO_3$ (R = La, Pr, Nd, Sm, Y) heterostructures was studied. The interfacial RO monolayer with a +1 valence is expected to donate one electron per unit cell to neighboring TiO_2 layers in $SrTiO_3$, resulting in a conducting 2DEG confined near the *R*O monolayer. We observe such conducting interfaces with LaO, PrO, and NdO monolayers, but find that the heterostructures doped with SmO and YO monolayers are insulating. Also, there is a critical thickness of $SrTiO_3$ needed for the interfaces to become conducting. The temperature dependence of the carrier concentration is similar for samples doped with La and Pr, but for samples doped with Nd, the carrier concentration decreases dramatically with decreasing temperature. We probe the interface structure in the LaO and SmO doped samples with EELS and X-ray diffraction in order to find a correlation between the interface structure and conductivity.

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