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Metal-insulator transition at lanthanum aluminate-strontium titanate interface induced by oxygen plasma treatment. WEITAO DAI, CHENG CEN, West Virginia Univ — The formation of two-dimensional electron gas (2DEG) at lanthanum aluminate (LAO)-strontium titanate (STO) interface, as well as the 2DEG's unique characters in metal-insulator transition, have evoked widespread interest. Highly insulating interfaces are obtained for the structures with LAO thickness below 3 unit cell (uc) and abrupt transition from an insulating to conducting interface was observed for samples with thicker LAO layers. For 3uc LAO/STO samples, reversible nanoscale control of the metal-insulator transition was implemented by a conductive AFM writing. Our research furtherly discovered a very stable metal-insulator transition can be achieved by oxygen plasma (OP) treatment for samples with thicker LAO layers. AFM imaging and XPS measurement demonstrated the low energy OP treatment altered only the surface bonds, which confirmed the importance of surface properties in the heterostructures. Then microscale Hall bars were patterned at the interface and imaged by electrostatic force microscope. Their transport and magnetic properties were measured. This research will promote deeper understanding about the interfacial metal-insulator transition mechanism and open new device opportunities. This work is supported by the Department of Energy Grant No. DE-SC-0010399 and National Science Foundation Grant No. NSF-1454950.

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