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Role of the surface in the interfacial metal-insulator transition in $LaAlO_3/SrTiO_3$[1]

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The observed metal-insulator transition in thin films of $LaAlO_3$ on $SrTiO_3$ depends critically on the film thickness: a reversible transition consistently works best with films 3 unit cells thick. Using first-principles density functional calculations, the role of the surface in the interfacial metal insulator transition will be examined. Water adsorbs strongly to the surface, dissociating and causing an unusual striped reconstruction. The adsorbates allow the creation of wires and devices at the interface. The positively charged AFM removes OH adsorbates, changing the interface from insulating to metallic. The negatively charged AFM removes H adsorbates, reversing the process.

[1]C. Cen, S. Thiel, G. Hammerl, C. W. Schneider, K. E. Andersen, C. S. Hellberg, J. Mannhart, and J. Levy, Nature Materials 7, 298 (2008).