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Conductance and gating effects at sputtered oxide interfaces

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Propositions

accompanying the thesis

Conductance and Gating Effects at Sputtered Oxide Interfaces

1. The fact that, in $\text{LaAlO}_3/\text{SrTiO}_3$ heterostructures, the interfacial conductivity is only observed for Al-rich LaAlO_3 layers points to oxygen vacancies being the doping mechanism.
Chapter 3 of this thesis.
2. Electron trapping appears to be a universal phenomenon in SrTiO_3 -based two-dimensional electron systems when applying a gate voltage at the back of the substrate.
Chapter 4 of this thesis.
3. Applying an external electric field can tune the Rashba spin-orbit coupling at the $\text{LaAlO}_3/\text{SrTiO}_3$ interface, but the effect is due to Fermi level variations, and therefore indirect.
Chapter 5 of this thesis.
4. The Kondo effect at the $\text{LaAlO}_3/\text{SrTiO}_3$ interface is caused by the interactions between itinerant and localized electrons rather than between itinerant electrons and conventional magnetic impurities, such as iron.
Chapter 6 of this thesis.
5. Warusawithana *et al.* conclude that a polar discontinuity is the mechanism for conductivity at the $\text{LaAlO}_3/\text{SrTiO}_3$ interface, but that does not explain why stoichiometric samples are insulating.
Warusawithana et al., Nat. Commun. 4, 2351 (2013).
6. Contrary to the assertion of Biscaras *et al.*, we find no filling threshold for electron trapping in $\text{LaAlO}_3/\text{SrTiO}_3$ heterostructures.
Biscaras et al., Sci. Rep. 4, 6788 (2014).
7. The quantum well depth of about 250 meV, measured on the surface of cleaved single crystals of SrTiO_3 , suggests that cleaving, even at low temperatures, introduces a large amount of oxygen vacancies.
King et al., Nat. Commun. 5, 3414 (2014).
8. Complex oxide heterostructures allow novel functionalities on one hand, but on the other hand the complexity hampers implementation in real devices.
Huang et al., Adv. Mater. 30, 1802439 (2018).
9. "Science has no borders" will probably never happen.

Chunhai Yin
Leiden, 03-07-2019