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Growing oxide thin films in a low-energy electron microscope

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Stellingen

Behorende bij het proefschrift
"Growing oxide thin films in a Low-Energy Electron Microscope"

1. Electron microscopy provides the only direct way to investigate oxide growth on the nanometer scale, given the combined requirements of high temperatures, real-time imaging and non-contact measurements.
Chapter 5 of this thesis
2. The advantage of low-energy electron microscopy over reflection high-energy electron diffraction in monitoring thin-film growth lies in the possibility to capture both real-space information and reciprocal-space data, specifically wave-vector dependent electron reflectivity.
Chapter 3 of this thesis
3. Electron reflectivity measurements allow conclusions about the stoichiometry of the surface of homoepitaxially grown SrTiO₃.
Chapter 5 of this thesis
4. The unoccupied band structure of the surface of the LaAlO₃ layer grown on a SrTiO₃ substrate is a good predictor of the conductivity of the LaAlO₃/SrTiO₃ interface.
Chapter 6 of this thesis
5. Francis *et al.* investigated the surface structure of LaAlO₃ by measuring X-ray surface truncation rods, combined with simulations of possible surface structures. Since they only considered a singly terminated surface, their conclusions may not be correct.
R. J. Francis et al., Phys. Rev B 64, 235425 (2001) and chapter 4 of this thesis.
6. The predicted low work function of SrVO₃ makes this the prime candidate material as an emitter in low-energy transmission electron microscopy.
R. Jacobs, J. Booske, and D. Morgan, arXiv 1607.02121
7. In experiments on delta-doped oxide interfaces consisting of LaAlO₃/EuTiO₃/SrTiO₃, the quoted amount of 10% La substitution in EuTiO₃ is enough to change this material from an antiferromagnetic insulator to a ferromagnetic metal. The interface may actually play no role in the observed conductivity.
D. Stornaiuolo et al., Nat. Mat. 15, 278 (2015)
8. The surface sensitivity of the hard X-ray technique used by Weiland *et al.* is too low to justify strong conclusions about the stoichiometry of the LaAlO₃ surface of their LaAlO₃/SrTiO₃ heterostructures.
C. Weiland et al., Phys. Rev. B 91, 165103 (2015).
9. Financing of research by short-term grants only is inefficient and wasteful, since the ensuing lack of continuity means loss of knowledge and suboptimal use of investments.

Alexander J.H. van der Torren,
Leiden, 5 December 2016