Growth and Transport Properties of [Rare Earth]TiO3/SrTiO3 Interfaces

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Stellingen

Behorend bij het proefschrift

GROWTH AND TRANSPORT PROPERTIES OF [Rare Earth]TiO_3 /$SrTiO_3$ INTERFACES

1. The anomalous Hall effect is not exclusively observed in ferromagnets. Therefore, its observation is not sufficient to conclude the existence of long-range ferromagnetic order.

   Chapter 3 of this thesis

2. Spatial inhomogeneities on the atomic scale significantly affect the electrical transport properties of conducting oxide interfaces.

   Chapter 4 and 5 of this thesis

3. The occurrence of hysteretic magnetoresistance in the superconducting state is not necessarily a sign of coexistence of magnetism and superconductivity in $SrTiO_3$-based oxide interfaces.

   Chapter 5 of this thesis

4. The resistance of conducting oxide interfaces with $SrTiO_3$ as a substrate can show an upturn towards low temperatures by putting a 'back gate' voltage on the substrate. This upturn can be explained by the properties of $SrTiO_3$ and do not need invoking the magnetic "Kondo" scenario.

   Chapter 6 of this thesis

5. In studying $NdGaO_3$/$SrTiO_3$ interfaces, Gunkel *et al.* find smaller values of the Anomalous Hall effect (AHE) for samples with a higher amount of oxygen vacancies and, supposedly, a larger number of Ti^{3+} ions. They conclude that the AHE derives from a different mechanism than the control of Ti^{3+}-ions and their magnetism by oxygen vacancies. This is unwarranted, since oxygen vacancies control more than just the amount of Ti^{3+} at the interface.

   F. Gunkel et al., Phys. Rev. X ***6****, 031035 (2016).*

6. Joshua *et al.* and Ruhman *et al.* give an explanation for the occurrence of two different anisotropy regimes, found in magnetotransport measurements on conducting $LaAlO_3/SrTiO_3$ interfaces, purely based on orbital symmetry arguments. Despite the beauty of its simplicity, the argument neglects many properties of $SrTiO_3$ and, therefore, may be misleading.

   *A. Joshua et al., PNAS **110** (24) 9633-9638 (2013);*
   *J. Ruhman et al., Phys. Rev. B **90**, 125123 (2014).*

7. The interplay between spin-orbit coupling and the anomalous Hall effect is more complicated than that both effects are simply in competition.

   *D. Stornaiuolo et al., Phys. Rev. B **98**, 075409 (2018).*

8. The coexistence of superconductivity and magnetic phenomena at oxide interfaces cannot be understood until the connection of those phenomena with spin-orbit coupling is understood.

   *S. Gariglio et al., APL Materials **4**, 060701 (2016).*

9. The current funding and publishing systems does not put sufficient value on the independent reproducibility of experimental results.

10. A science career is like going through a minefield: it requires nerves and luck, and one never knows how long it will last.

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Leiden, December 1, 2020