

Scanning transmission electron microscope investigation of LaAlO₃/SrTiO₃ bi-interface

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In the 2004 the occurrence of a two dimensional electron gas (2DEG) was discovered at the interface between two wide-bandgap insulators: a thin film of LaAlO₃ (LAO) grown on a TiO₂-terminated SrTiO₃ (STO) crystal. More recently an LAO thin film on an STO thin film homo-epitaxially grown on an STO crystal was investigated. A 2DEG in the LAO thin film / STO thin film / STO system was achieved for the first time [2].

In this work we investigated an LAO/STO bi-interface system with the structure: LAO layer / STO layer / LAO layer / STO TiO₂-terminated substrate, to shed light on its transport properties. High-angle annular dark-field (HAADF), annular bright field (ABF) images as well as electron energy-loss spectra (EELS) were collected using an aberration-corrected scanning transmission electron microscope (STEM). This investigation provided a large amount of useful information, such as the intermixing rate of La, Ti, Sr, Al at the interfaces i.e. the sharpness or the roughness of the interfaces, the termination planes, the fine structure (O K and Ti L_{2,3} edges) and the lattice dislocations.

Reference

[1] A. Ohtomo & H.Y. Hwang, *Nature* **427**, 423 (2004)

[2] Danfeng Li, S. Gariglio, C. Cancellieri, A. Fete, D. Stornaiuolo and J.-M. Triscone, *APL Materials* **2**, 012102 (2014)