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Chen, Yunzhong; Trier, Felix; Christensen, Dennis Valbjørn; Linderoth, Søren; Pryds, Nini

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4.5 Two-dimensional electron gases at a spinel/perovskite complex oxide heterointerface with electron mobilities exceeding 100,000 $cm^2V^{-1}s^{-1}$

Y. Z. Chen, F. Trier, D. V. Christensen, S. Linderoth, and N. Pryds
Department of Energy Conversion and Storage, Technical University of Denmark, Risø Campus, 4000 Roskilde, Denmark

The high-mobility two-dimensional electron gas (2DEG) confined at the interface of two insulating complex oxides provides opportunities for a new generation of electronic devices. So far, such oxide 2DEG is nearly exclusively created within the frame of interface polarity, such as the case of the intensively explored $LaAlO_3/SrTiO_3$ (LAO/STO) heterointerface. Alternatively, when building heterostructures on STO, the basis material for oxide electronics, the conductance can also originate from tunable redox reactions at the interface, i.e. the oxygen-vacancies dominated conductivity in reduced STO substrates [1]. In this presentation, the mechanism of the interface conductance in STO-based oxide heterostructures will be discussed. Moreover, relying on redox reactions, we created a new type of 2DEG at the heterointerface between $SrTiO_3$ and a spinel γ-Al_2O_3 epitaxial film with compatible oxygen ions sublattices [2]. Electron mobilities more than one order of magnitude higher than those of hitherto investigated perovskite-type interfaces were obtained. The spinel/perovskite 2DEG, where the two-dimensional conduction character is revealed by quantum magnetoresistance oscillations, is found to result from interface-stabilized oxygen vacancies confined within a layer of 0.9 nm in proximity to the interface. Our findings pave the way for studies of mesoscopic physics with complex oxides and design of high-mobility all-oxide electronic devices

1. Y. Z. Chen *et al.*, *Nano Lett.* **11**, 3774 (2011).

2. Y. Z. Chen *et al.*, *Nature Communications*. doi:10.1038/ncomms2394 (2012) (*in progress*).

Corresponding author: Yunzhong Chen, Email: yunc@dtu.dk, *Frederiksborgvej 399, DK 4000, Roskilde, Denmark, Tel: +45 4677 5614; Fax: +45 4677 5858*