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## A Two-Dimensional Electron Gas at the Spinel/Perovskite Interface of -Al<sub>2</sub>O<sub>3</sub>/SrTiO<sub>3</sub> with Carrier Mobility Exceeding 100,000 cm<sup>2</sup>V<sup>-1</sup>s<sup>-1</sup>

Chen, Yunzhong; Bovet, N.; Trier, Felix; Christensen, Dennis Valbjørn; Qu, F.M.; Andersen, Niels Hessel; Kasama, Takeshi; Zhang, Wei; Giraud, R.; Dufouleur, J.; Jespersen, T. S.; Sun, J.R.; Smith, Anders; Nygård, J.; Lu, L.; Büchner, B.; Shen, B.G.; Linderoth, Søren; Pryds, Nini

*Publication date:*  
2013

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### *Citation (APA):*

Chen, Y., Bovet, N., Trier, F., Christensen, D. V., Qu, F. M., Andersen, N. H., ... Pryds, N. (2013). A Two-Dimensional Electron Gas at the Spinel/Perovskite Interface of -Al<sub>2</sub>O<sub>3</sub>/SrTiO<sub>3</sub> with Carrier Mobility Exceeding 100,000 cm<sup>2</sup>V<sup>-1</sup>s<sup>-1</sup>. Abstract from 20th Workshop on Oxide Electronics (WOE20), Singapore, Singapore.

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## A Two-Dimensional Electron Gas at the Spinel/Perovskite Interface of $\gamma\text{-Al}_2\text{O}_3/\text{SrTiO}_3$ with Carrier Mobility Exceeding $100,000 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$

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The discovery of two-dimensional electron gases (2DEGs) at the heterointerface between two insulating perovskite-type oxides, such as  $\text{LaAlO}_3$  and  $\text{SrTiO}_3$  [1], provides opportunities for a new generation of all-oxide electronic devices [2]. Key challenges remain for achieving interfacial electron mobilities much beyond the current value of approximately  $1000 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$  (at low temperatures). Here, we create a new type of 2DEG at the heterointerface between  $\text{SrTiO}_3$  and a spinel  $\gamma\text{-Al}_2\text{O}_3$  epitaxial film with compatible oxygen ions sublattices [3]. Electron mobilities more than one order of magnitude higher than those of hitherto investigated perovskite-type interfaces are obtained. Particularly, electron Hall mobilities as large as  $1.4 \times 10^5 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$  and  $n_s$  as high as  $3.7 \times 10^{14} \text{ cm}^{-2}$  at 2 K is obtained at this spinel/perovskite complex oxide interface [3]. The spinel/perovskite 2DEG, where the two-dimensional conduction character is revealed by quantum magnetoresistance oscillations, is found to be strongly coupled to 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.

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Y. Z. Chen et al. *Nat. Commun.* 4:1371, doi: 10.1038/ncomms2394 (2013).