



## A high mobility two-dimensional electron gas at the CaZrO<sub>3</sub>/SrTiO<sub>3</sub> heterointerface

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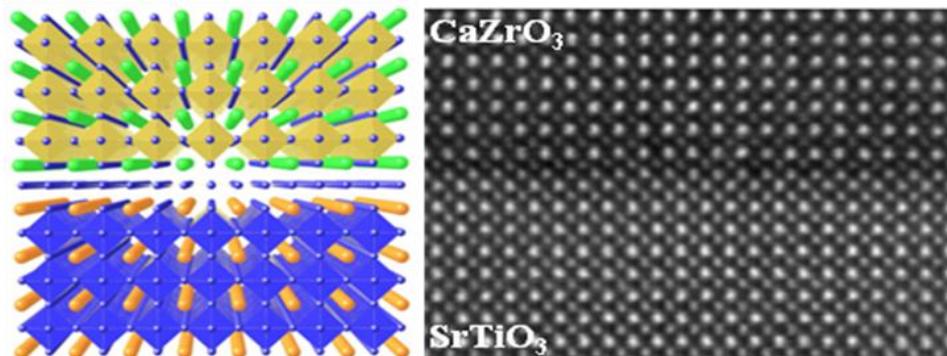
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## A high mobility two-dimensional electron gas at the $\text{CaZrO}_3/\text{SrTiO}_3$ heterointerface

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The discovery of two-dimensional electron gases (2DEGs) in  $\text{SrTiO}_3$ -based heterostructures provides new opportunities for nanoelectronics<sup>1,2</sup>. Herein, we create a new type of oxide 2DEG by the epitaxial-strain-induced polarization at an otherwise nonpolar perovskite-type interface of  $\text{CaZrO}_3/\text{SrTiO}_3$ .<sup>3,4</sup> Remarkably, this heterointerface is atomically sharp, and exhibits a high electron mobility exceeding  $60,000 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$  at low temperatures. The 2DEG carrier density exhibits a critical dependence on the film thickness, in good agreement with the polarization induced 2DEG scheme.



**Figure 1.** Atomically-flat epitaxially grown perovskite-type interface of  $\text{CaZrO}_3/\text{SrTiO}_3$  determined by STEM-EELS.

### Reference:

1. A. Ohtomo, H. Y. Hwang, A high-mobility electron gas at the  $\text{LaAlO}_3/\text{SrTiO}_3$  heterointerface. *Nature* **427**, 423-426 (2004).
2. Chen Y. Z. *et al.* A high-mobility two-dimensional electron gas at the spinel/perovskite interface of  $\gamma\text{-Al}_2\text{O}_3/\text{SrTiO}_3$ . *Nature Commun.* **4**, 1371 (2013).
3. Chen Y. Z. *et al.* Creation of high mobility two-dimensional electron gases via strain induced polarization at an otherwise nonpolar complex oxide interface. *Nano Lett.* **15**, 1849 (2015).
4. S. Nazir, J. Cheng, K. Yang, Creating Two-Dimensional Electron Gas in Nonpolar/Nonpolar Oxide Interface via Polarization Discontinuity: First-Principles Analysis of  $\text{CaZrO}_3/\text{SrTiO}_3$  Heterostructure. *ACS appl. Mater. Interfaces.* **8**, 390 (2016).