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

Publication date:
2016

Document Version
Peer reviewed version

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Citation (APA):
A high mobility two-dimensional electron gas at the CaZrO$_3$/SrTiO$_3$ heterointerface

Y.Z. Chen$^*$, F. Trier, D. V. Christensen, S. Linderoth, and Nini Pryds  
Department of Energy Conversion and Storage, Technical University of Denmark, Roskilde, Denmark  
*yuc@dtu.dk

The discovery of two-dimensional electron gases (2DEGs) in SrTiO$_3$-based heterostructures provides new opportunities for nanoelectronics$^{1,2}$. Herein, we create a new type of oxide 2DEG by the epitaxial-strain-induced polarization at an otherwise nonpolar perovskite-type interface of CaZrO$_3$/SrTiO$_3$. Remarkably, this heterointerface is atomically sharp, and exhibits a high electron mobility exceeding 60,000 cm$^2$V$^{-1}$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 CaZrO$_3$/SrTiO$_3$ determined by STEM-EELS.

Reference: