Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Thermodynamic Stability of Ferroelectric Oxide Surface in Pulsed Laser Deposition: Novel Way to Atomic-scale Interface Control.[1]
YEONG JAE SHIN, LINGFEI WANG, Center for Correlated Electron Systems, Institute for Basic Science (IBS), Seoul, Republic of Korea, YOONKOO KIM, MIYOUNG KIM, Department of Materials Science and Engineering, Seoul National University, Seoul, Republic of Korea, SEO HYOUNG CHANG, Department of Physics, Pukyong National University, Busan 608-737, Republic of Korea, TAE WON NOH, Center for Correlated Electron Systems, Institute for Basic Science (IBS), Seoul, Republic of Korea — We demonstrated the selective fabrication of BaO-RuO_2 and TiO_2-SrO atomic sequence at the interface of epitaxial $SrRuO_3$/$BaTiO_3$/$SrRuO_3$ (SRO/BTO/SRO) heterostructure using pulsed laser deposition (PLD). The growth conditions for stabilizing each interface structure are strongly related to the phase diagram of BTO surface structure expected from thermodynamic equilibria. The approach allows us precise control of desired sequence of atomic layers with abrupt interfaces. By simply adjusting the oxygen partial pressure, we obtained an abrupt BTO top interface with a TiO_2 termination. The interface-controlled BTO exhibits a robust ferroelectricity down to a thickness of 3.5 unit cells (˜1.4 nm)— a theoretical limit that has to date remained elusive in experiment. Despite PLD has been considered to have non-equilibrium nature, these results highlight that thermodynamic considerations are useful to identify the correct stoichiometric surface/interface terminations.

[1]This work was supported by IBS-R009-D1 through the Research Center Program of the Institute for Basic Science in Korea.

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Date submitted: 20 Nov 2016 Electronic form version 1.4