Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

SrTiO3 single crystal field-effect transistor with an amorphous CaHfO3 gate insulator KEISUKE SHIBUYA, TSUYOSHI OHNISHI, TAKAYUKI UOZUMI, MIKK LIPPMAA, The University of Tokyo, HIDEOMI KOINUMA, Tokyo Institute of Technology — It becomes more and more important to understand the electronic properties of interfaces in transition-metal oxides from a viewpoint of utilizing such materials in devices; tunneling magnetoresistance (TMR) junctions, resistance random access memory (RRAM), or field-effect transistors (FET). $SrTiO_3$ is a wide-gap semiconductor and a good model system for studying the electronic structure of various oxides with similar crystal structures. We have fabricated a field-effect transistor composed of $SrTiO_3$ (100) single crystal as a channel and an amorphous $CaHfO_3$ layer as a gate insulator. The amorphous $CaHfO_3$ gate insulator layer, grown by pulsed laser deposition, was atomically flat and had an average breakdown field of 5 MV/cm. All electrode and channel patterning was done with simple contact masks. The device showed prominent n-type transistor operation, a field-effect mobility of 0.4 to 0.5 cm^2 / V s, and an on-to-off channel current ratio of $\sim 10^5$ at room temperature. However, an improvement of these transistor properties was not observed at low temperatures. The device performance was limited by the electric structure of the interface.

Keisuke Shibuya
The University of Tokyo

Date submitted: 01 Dec 2004 Electronic form version 1.4