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Effect of strain on ferroelectric field effect in strongly correlated oxide $Sm_{0.5}Nd_{0.5}NiO_3$[1] LE ZHANG, XUEGANG CHEN, H. JEFFREY GARDNER, Dept. of Physics and Astronomy, University of Nebraska Lincoln, MARK A. KOTEN, JEFFREY E. SHIELD, Dept. of Mechanical Engineering, University of Nebraska Lincoln, XIA HONG, Dept. of Physics and Astronomy, University of Nebraska Lincoln — We report the effect of epitaxial strain on the magnitude and retention of the ferroelectric field effect in a prototype FerroFET based on a charge transfer-type Mott insulator, $Sm_{0.5}Nd_{0.5}NiO_3$ (SNNO). It has been shown that epitaxial strain can change the transition temperature T_{MI} in SNNO by more than 100 K, and modify the metal-insulator transition (MIT) characteristic between first-order and second-order. We have fabricated epitaxial $PbZr_{0.3}Ti_{0.7}O_3$ (PZT)/3.8–4.3 nm SNNO heterostructures on (001) $LaAlO_3$ (LAO) and $SrTiO_3$ (STO) substrates. The magnitude of the field effect modulation can differ by more than one order of magnitude in these two systems, which has been attributed to strain modified MIT characteristic in SNNO. In both systems, we also observe a pronounced relaxation of off state resistance R_{off}, showing a thermally activated behavior with corresponding activation energy of 22 meV (28 meV) for devices on LAO (STO). The time dynamics and thermal response of the retention behavior suggest that strain-induced oxygen vacancies play a critical role in the ferroelectric field effect instability.

[1]L. Zhang et al., Appl. Phys. Lett. 107, 152906 (2015)

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