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Ferroelectric Field Effect in Ultrathin Epitaxial $Sm_{0.5}Nd_{0.5}NiO_3$ Films LE ZHANG, H. JEFFREY GARDNER, VIJAY RAJ SINGH, XIA HONG, University of Nebraska - Lincoln — We report the study of ferroelectric field effect modulation of the metal-insulator transition in ultrathin $Sm_{0.5}Nd_{0.5}NiO_3$ (SNNO) films. We have fabricated high quality epitaxial SNNO thin films and Pb(Zr,Ti)O_3 (PZT)/SNNO heterostructures on (001) $LaAlO_3$ substrates using off-axis RF magnetron sputtering. X-ray diffraction and atomic force microscopy studies reveal (001) oriented films with highly crystallinity and surface roughness of 3-4 Å. Thin SNNO films (4-6 nm) typically have the transition temperature T_{MI} around 230 K, showing thermally activated transport below T_{MI} followed by 3D variable range hoping at low temperature. Hall effect measurements reveal p-type conduction with $\sim$ 4 holes/uc in the metallic phase. Working with films one to two unit cells thicker than the electrical dead layer thickness ($\sim$ 4 nm), we have demonstrated nonvolatile, reversible ferroelectric field effect modulation of T_{MI} in SNNO by up to 10 K. The maximum resistance ratio R_{high}/R_{low} is 1.7 at 140 K, which is in the thermally activated regime. In the metallic phase, the carrier density has been modulated by 1x10^{15} cm^{-2}, corresponding to the polarization field of PZT of 80 $\mu C/cm^2$.

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