Stoichiometric and Interfacial Assessment of $Ba_xSr_{1-x}TiO_3$ (x=0, 0.50, 1.0)/p-Si(110) Heterojunction Devices

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A common wet chemical process is optimized to produce BaxSr1-xTiO3 (x=0, 0.50, 1.0) thin films on p-Si (110) substrates, resulting in cubic SrTiO3, Ba0.5Sr0.5TiO3 and tetragonal BaTiO3 in O2 ambient conditions (100 sccm) at 700 °C. Through X-ray diffractometer (XRD) and X-ray photoelectron spectroscopy (XPS) characterizations the crystallographic phase and band alignment of BaxSr1-xTiO3/Si(110) were studied. A simplest Ag/BaxSr1-xTiO3/Si(110)/Ag and Al/BaxSr1-xTiO3/Si(110)/Pt device structure was assembled to study the deep and shallow levels via capacitance-voltage (C-V) features. Substantial hysteresis (V) was observed for Ba0.5Sr0.5TiO3 and BaTiO3. The observed shift in the binding energy of the core level spectra and the difference in V were explained in the light of band off-set, chemical environment and probable interfacial defect states.