Interfacial phases of strontium bismuth tantalate films on Pt heterostructure bottom electrodes

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Strontium bismuth tantalate (SBT) precursor solutions with a nominal composition of $Sr_{0.8}Bi_{2.2}Ta_2O_9$ were deposited onto substrates with two different heterostructures: $Pt/TiO_2/SiO_2/(100)Si$ and $Ti/Pt/Ti/SiO_2/(100)Si$. The films were crystallised in oxygen atmosphere with a thermal treatment that consisted on a first annealing at 550ºC for 7200 seconds followed by the heating at 700ºC for 3600 seconds. Average heating rate of the process was ~8ºC/s. Crystalline phases developed in the films were monitored by x-ray diffraction analysis (XRD). The SBT layered perovskite is formed in both films, but a peak associated to a secondary phase is detected in the x-ray patterns at about 2θ~30º. The relative intensity of this peak is higher in the SBT films on $Ti/Pt/Ti/SiO_2/(100)Si$ compared to that on $Pt/TiO_2/SiO_2/(100)Si$. Profile compositions of the films and the nature of the electrode-film interface were studied by Rutherford Backscattering Spectroscopy (RBS) and X-ray Photoelectron Spectroscopy (XPS). These studies indicate that profile compositions of the SBT layers are homogeneous in both films, whereas the nature of the electrode-film interface is different. The films onto $Ti/Pt/Ti/SiO_2/(100)Si$ develop a reaction interface with Pt contaminated with Bi, Ti and O, whereas the films onto $Pt/TiO_2/SiO_2/(100)Si$ have a very thin interface only formed by Pt and Bi. Besides, in the former the Ti layers initially put on and under the Pt are not detected by RBS and XPS.
Ferroelectric hysteresis loops, fatigue and leakage current densities have been measured in both films. Effect of the electrode-film interface on the electrical responses is discussed.