Improved ReRAM behaviors in $Ba_{0.7}Sr_{0.3}TiO_3$ layer with Nb dopant

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In this research, we investigated the effects of niobium (Nb)-doping on the resistance switching properties in Pt/$Ba_{0.7}Sr_{0.3}TiO_3$(BST)/Pt ReRAM devices. 0.5 at% Nb-doped & undoped BST thin films were deposited on Pt/Ti/SiO_2/Si substrate by RF magnetron sputtering and the bipolar switching behaviors were shown in both undoped & Nb-doped BST thin films repeatedly. The resistance ratios of OFF state/On state for both cases were ~ 10^4 and these values were maintained for 10^4 seconds. The surface structures of undoped & Nb-doped BST were measured by AFM and SEM, which can confirm that the deviation of grain size and the mean grain size were decreased by Nb doping. Current mapping images of undoped & Nb-doped BST by C-AFM were obtained after electroforming process with -7V electrical stress. We observed a few blunt current paths under negatively charged electric field and the conducting paths of undoped & Nb-doped BST thin films were randomly distributed over 1μm^2 area. It is notable that there has been an improvement in the homogeneity for size of the conducting paths when Nb was doped in undoped BST thin films. In consequence of this, the uniformity of ReRAM behaviors for Nb-doped BST was improved.