NT-P011

Nanoscale Probing of Switching Behaviors of Pt Nanodisk on STO Substrates with Conductive Atomic Force Microscopy

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The resistive switching behaviors of Pt nanodisk on Nb-doped SrTiO3 single-crystal have been studied with conductive atomic force microscopy in ultra-high vacuum. The nanometer sizes of Pt disks were formed by using self-assembled patterns of silica nanospheres on Nb-doped SrTiO3 single-crystal semiconductor film using the Langmuir-Blodgett, followed by the metal deposition with e-beam evaporation. The conductance images shows the spatial mapping of the current flowing from the TiN coated AFM probe to Pt nanodisk surface on Nb : STO single-crystal substrate, that was simultaneously obtained with topography. The bipolar resistive switching behaviors of Pt nanodisk on Nb : STO single-crystal junctions was observed. By measuring the current-voltage spectroscopy after the forming process, we found that switching behavior depends on the charging and discharging of interface trap state that exhibit the high resistive state (HRS) and low resistive state (LRS), respectively. The results suggest that the bipolar resistive switching of Pt/Nb:STO single-crystal junctions can be performed without the electrochemical redox reaction between tip and sample with the potential application of nanometer scale resistive switching devices.

Keywords: Resistive switching, Pt nanodisk on Nb:STO single-crystal, Conductive atomic force microscopy