Title: Bipolar Resistive Switching in Si/Ag Nanostructures

Author: C. Dias H. Lv R. Picos P. Aguiar S. Cardoso P.P. Freitas J. Ventura

PII: S0169-4332(17)30153-8
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2017.01.140
Reference: APSUSC 34935

To appear in: *APSUSC*

Received date: 4-10-2016
Revised date: 11-1-2017
Accepted date: 14-1-2017

Please cite this article as: C. Dias, H. Lv, R. Picos, P. Aguiar, S. Cardoso, P.P. Freitas, J. Ventura, Bipolar Resistive Switching in Si/Ag Nanostructures, *<![CDATA[Applied Surface Science]]>* (2017), http://dx.doi.org/10.1016/j.apsusc.2017.01.140

Bipolar Resistive Switching in Si/Ag Nanostructures

C. Dias[a,*], H. Lv[b], R. Picos[c], P. Aguiar[d,e], S. Cardoso[b], P. P. Freitas[b], J. Ventura[a,*]

[a] *IFIMUP and IN Institute of Nanotechnology, and Department of Physics and Astronomy, Faculty of Sciences, University of Porto, Porto, Portugal*
[b] *INESC-MN and IN - Institute of Nanoscience and Nanotechnology, Lisboa, Portugal*
[c] *Electronic Engineering Group, Physics Department, Universitat de les Illes Balears, Palma de Mallorca, Spain*
[d] *i3S Instituto de Investigação e Inovação em saúde, Universidade do Porto, Portugal*
[e] *INEB Instituto de Engenharia Biomédica, Universidade do Porto, Portugal*

Abstract

Resistive switching devices are being intensively studied aiming a large number of promising applications such as nonvolatile memories, artificial neural networks and sensors. Here, we show nanoscale bipolar resistive switching in Pt/Si/Ag/TiW structures, with a dielectric barrier thickness of 20 nm. The observed phenomenon is based on the formation/rupture of metallic Ag filaments in the otherwise insulating Si host material. No electroforming process was required to achieve resistive switching. We obtained average values of 0.23 V and -0.24 V for the Set and Reset voltages, respectively. The stability of the switching was observed for over 100 cycles, together with a clear separation of the ON (10^3 Ω) and OFF (10^2 Ω) states. Furthermore, the influence of the Set current compliance on the ON resistance, resistances ratio and Set/Reset voltages percentage variation was also studied.

1. Introduction

Present computer processing capabilities are becoming a restriction to meet modern technological needs. Therefore, approaches beyond the von Neumann architecture are imperative and the brain's operation and structure are truly

*Corresponding authors
Email addresses: c.dias@fc.up.pt (C. Dias), joventur@fc.up.pt (J. Ventura)