Accepted Manuscript

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PII: S0925-8388(18)30074-4

DOI: 10.1016/j.jallcom.2018.01.072

Reference: JALCOM 44536

To appear in: *Journal of Alloys and Compounds*

Received Date: 19 October 2017

Revised Date: 4 January 2018

Accepted Date: 5 January 2018

Please cite this article as: Y.R. Chen, Z.M. Li, Z.W. Zhang, L.Q. Hu, H. Jiang, G.Q. Miao, H. Song, Annealing effect on the bipolar resistive switching characteristics of a Ti/Si_3N_4/n-GaN MIS device, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.01.072.

Annealing effect on the bipolar resistive switching characteristics of a Ti/Si_3N_4/n-GaN MIS device

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ABSTRACT

In this paper, the effect of annealing on the bipolar resistive switching characteristics of a Ti/Si_3N_4/n-GaN metal-insulator-semiconductor (MIS) structure memristor is demonstrated. The results show that the stability and repeatability of the bipolar resistive switching are greatly improved in annealed Ti/Si_3N_4/n-GaN MIS devices. The mechanism involved is revealed by both conductive force microscopy (CFM) and x-ray photoelectron spectroscopy (XPS). It is confirmed to *in-situ* local Ti doping in Si_3N_4 by thermal annealing and can be ascribed to the local Ti dopants in the Si_3N_4 bonding the N atoms at positive bias by electro-reductive process that benefits to form stable nanoscale Si filaments. On the contrary, the Si filaments rupture by recombining with N atoms near the n-GaN side at negative bias. The proposed device is apt to integrate with a GaN-based high electron mobility transistor (HEMT) to structure a one-transistor-one-resistor (1T1R) nonvolatile memory cell, which is