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Annealing effect on the bipolar resistive switching characteristics of a Ti/Si₃N₄/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/Si₃N₄/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/Si₃N₄/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 Si₃N₄ by thermal annealing and can be ascribed to the local Ti dopants in the Si₃N₄ 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

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