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Fabrication of Transparent Bistable Switching Memory Device Using Plasma-Polymerized Hexamethyldisiloxane Layers with Embedded Graphene Quantum Dots

Poh Choon Ooi[a,1,*], M. F. Mohd. Razip Wee [a,1], Chang Fu Dee[a,*], Chi Chin Yap[b], Muhammad Mat Salleh[a], Burhanuddin Yeop Majlis[a]

[a]Institute of Microengineering and Nanoelectronic, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia

[b]School of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia

ABSTRACT

We demonstrated the feasibility to fabricate two-terminal non-volatile-memory (NVM) devices using pulse radio frequency (rf) plasma polymerization and simple solution route. The two-terminal NVM devices were fabricated based on a metal-insulator-metal structure consisting of graphene quantum dots (GQDs) embedded in hexamethyldisiloxane dielectric layers. The charge trapping layer, GQDs and the top contacts were formed by spin coating and spray coating methods. Whereas, the dielectric layers were deposited using pulse rf plasma polymerization. The current-voltage curves showed a bistable current behavior with the presence of hysteresis window. The fabricated NVM memory devices were reprogrammable when the endurance test was performed and stable up to 1×10^4 s cycles with a distinct ON/OFF ratio of 10^4. Based on the obtained *I-V* characteristics, Schottky emission, Poole-Frenkel emission, trapped-charge limited-current and space-charge-limited current were proposed as the dominant conduction mechanisms for the fabricated NVM devices.

Keywords: Bistable switching, graphene quantum dot, hexamethyldisiloxane, plasma polymerization, conduction mechanisms

*Corresponding author: E-mail address: pcooi@gmx.com (P. C. Ooi); cfdee@ukm.edu.my (C. F. Dee)
1These authors contributed equally to this work.