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Resistive Switching Memory Device Fabricated Using Raw Organic Cow Milk as the Active layer

Abstract: Resistive switching memory is an emerging memory that stores data using the two electrically switchable resistive states, viz., the high resistive state (HRS) as the OFF-state and the low resistive state (LRS), as the ON-state. ReRAMs have the simplest architecture comprising an active material (a thin film) sandwiched between two electrodes. This simple cell structure allows for scaling even at the sub-nanometre level, better than the memory giants, i.e., dynamic random-access memory (DRAM) and Flash memory which have already shown scaling saturation. In this work, resistive switching properties of 3.6 μm thick raw organic full cream cow milk-based film have been investigated. To better understand the system, two devices were fabricated, viz., the Ag/milk/ITO and Ag/milk/W (where Ag, ITO and W are respectively the silver, indium doped tin oxide and W is tungsten electrodes) to allow for comparative results. Both devices showed 'S-type' bipolar memory behaviour. Furthermore, the Ag/milk/ITO showed switching at 0.77 V with an ON/OFF ratio of ~ 2, which lasted for about 7 write/erase cycles, thus showing prospects for nonvolatile memory application. The Ag/milk/W device, on the other hand, showed switching characterized by low (0.1 V) voltage which lasted only for one cycle. Increasing the compliance current up to 0.5 V improved the ON/OFF ratio up to 10^2 but still the device could not follow the same hysteresis behaviour twice. Overall, our results showed that environmentally friendly resistive switching memory devices can be fabricated using spin-coated organic cow milk-based film and that the choice of electrode material affects the memory behaviour of the device.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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