RRAM based analog synapse device for neuromorphic system

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Abstract

Brain-inspired neuromorphic computing system is promising alternative to overcome the limitations of von Neumann architecture due to the fault-tolerance and massive parallelism. To implement neuromorphic function, an electronic synapse device, which plays important role in storing weights data, should be developed. Among the various synapse devices, RRAM based analog synapse device has a strong potential due to the simple 2-terminal device structure, spike-timing dependent plasticity and low power consumption. In this paper, we report RRAM-based synapse device with $Mo/Pr_{0.7}Ca_{0.3}MnO_3$ (PCMO) structure showing multi-level states of conductance, retention, and excellent switching uniformity in k-bit cross-point array. Moreover, for the proper operation of the neuromorphic system with synapse, we utilize NbO_2 IMT device as an oscillator neuron. Finally, we have experimentally confirmed the pattern recognition using 11k-bit Mo/PCMO synapse array and NbO_2 oscillator neuron.