

Analysis of Atypical Switching Events in SiO_x ReRAM

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Resistance switching devices offer promising prospects for neuromorphic computing due to rich dynamics. The complex and convoluted physical processes that provide such opportunities are, on the other hand, hard to control and pose device engineering and operation optimisation challenges. In addition to expected device-to-device and cycle-to-cycle variability there are distinct changes in the device response as it is operated. In this work SiO_x redox-based memory (ReRAM) cells are tested to explore atypical switching events and connect them to transitions in the resistance switching thresholds by carrying out statistical analysis. To achieve that, a method is developed to qualitatively categorise the switching curves, and the switching metrics are compared across different classes. Pulsed sweeps with varied timings and write-verify scheme with different resistance targets are used to investigate how the switching behaviour is affected by device programming conditions. By revealing the underlying causes, we hope that with targeted device engineering and optimised operation the transitions in device characteristics could be exploited as a computational resource.