Electrical Characterization of Tantalum Oxide Based Memristor

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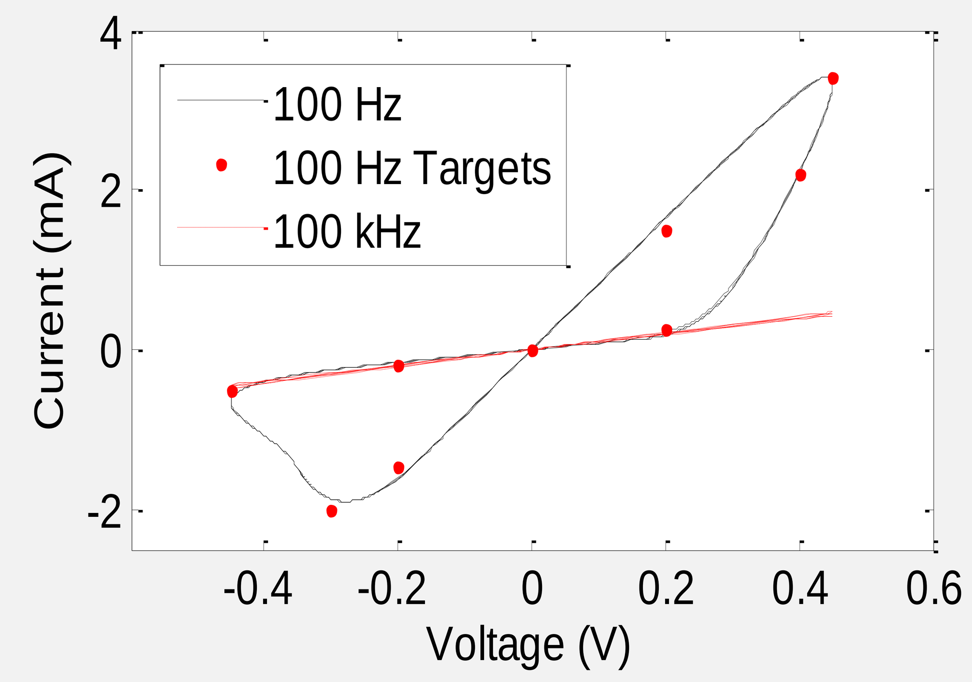
Abstract

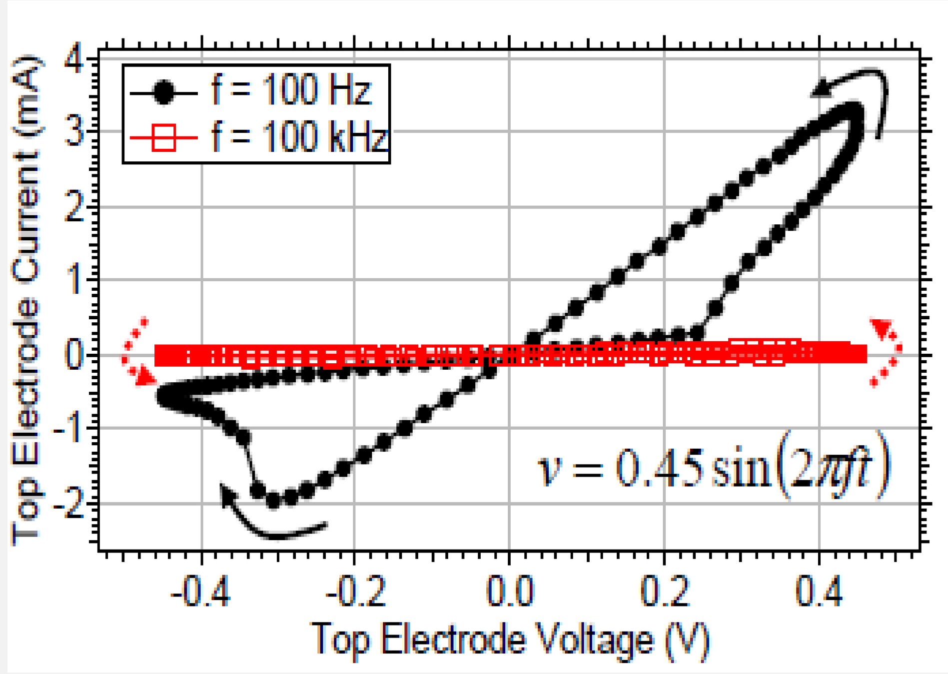
Neuromorphic computing approaches based on memristor devices can drastically reduce this power and allow low power devices (edge computing and IoT devices) to learn and thus become much smarter. This work presents collected characteristics data of real memristor devices and modeling for memristor-based circuit and system design. Memristors – a relatively recent class on nanoscale devices that can be programmed and can retain their data even when the power is turned off. Memristor based online circuits is a popular research topic currently, but these are generally based on ideal devices behaviors. Therefore, the acquired device properties are used to update the memristor model used in previous circuit simulations and examine its impact on Artificial Intelligence learning circuits.

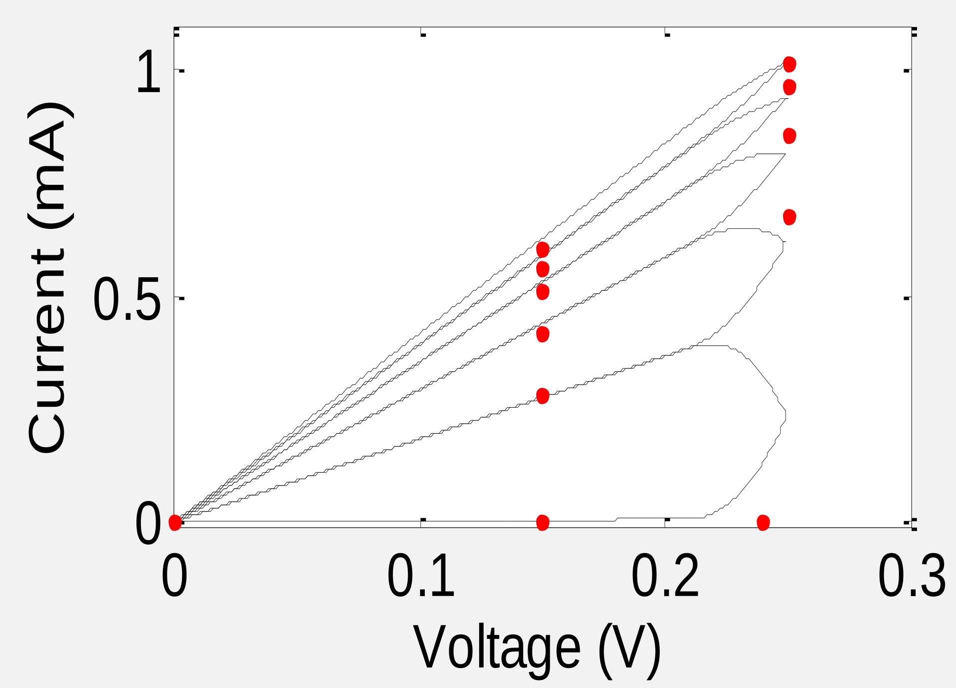
Objectives

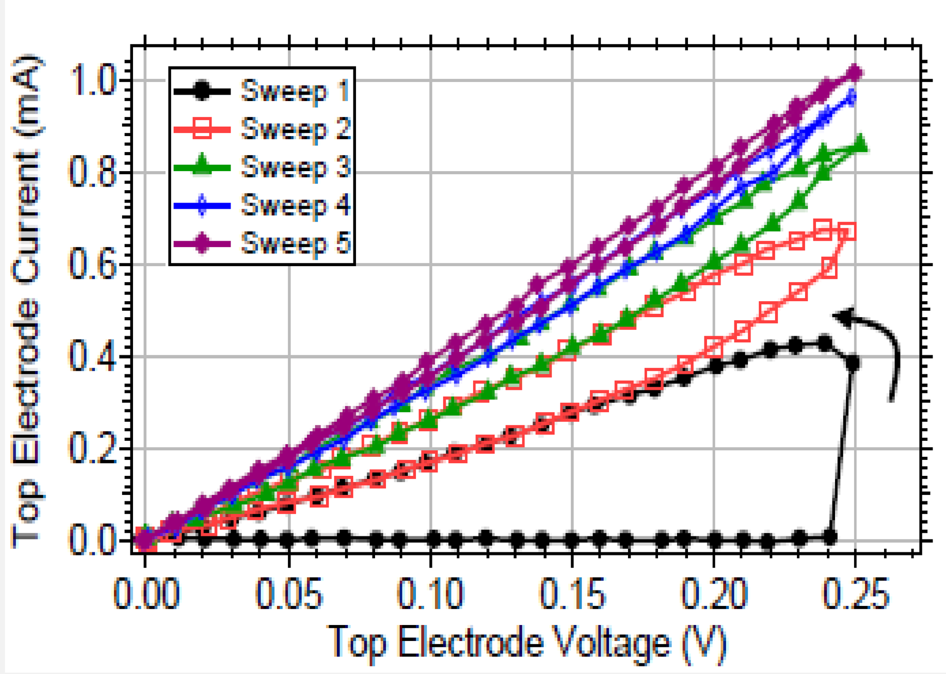
- ❖ Measure real memristor device properties on microseconds pulses
- ❖ Low power consumption with greater performance
- ❖ Study of Multi-state Resistive Switching
- ❖ Examine the impact of asymmetric memristive devices

Memristor Model Background

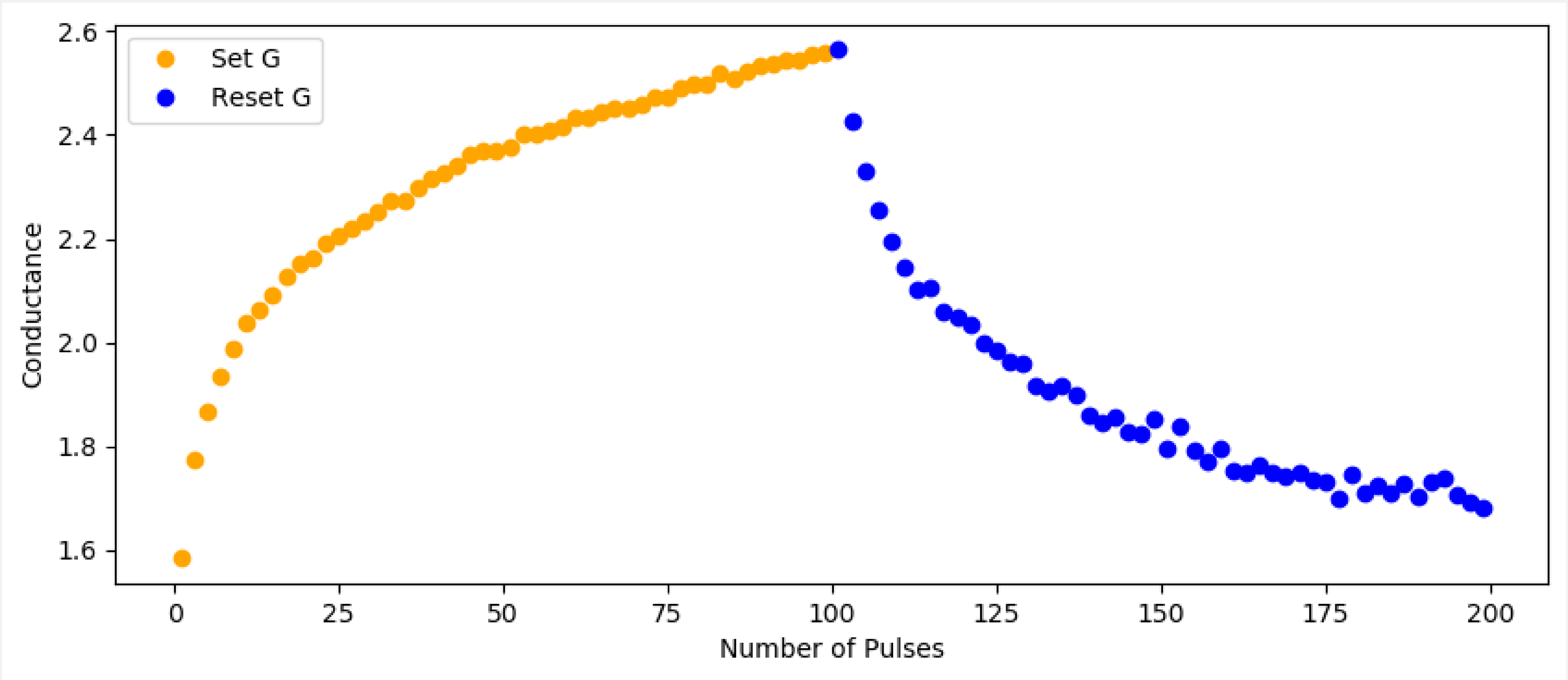








Anticipated Results



Measurement Setup

- ❖ Keysight 2911A Source Measure Unit
- ❖ Agilent 82357B GPIB Interface
- ❖ Quick IV Measurement Software
- ❖ SEM Probe station

Conclusion

TaOx is justified as a good replacement as transition metal oxide for designing memristor device for the on-chip learning applications

Future Work

- ❖ Update memristor model used in circuit simulations
- ❖ Study the appropriate circuits and deep learning algorithms to be carried out for these devices-based circuits
- ❖ Examine the impact of on-chip learning based memristor circuits on different machine learning benchmarks

Contact

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