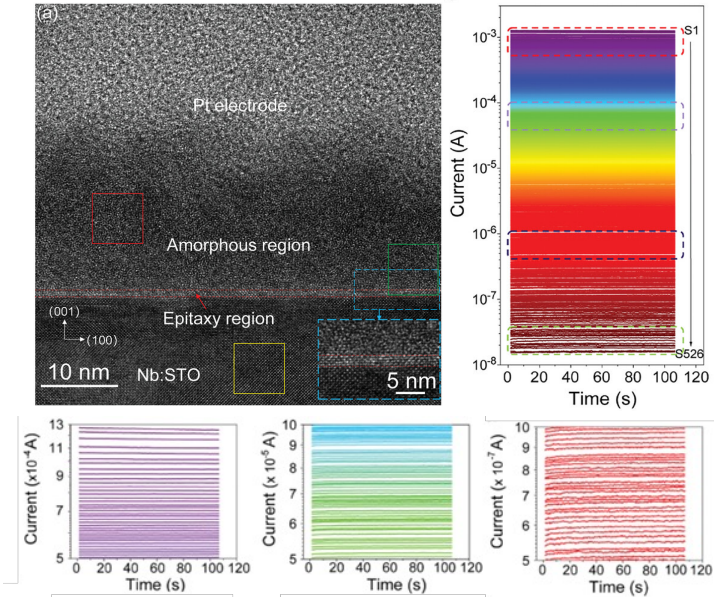
Ultra-Fast Multilevel Resistive Switching for Memory and Neuromorphic Computing

Scientific Achievement

A hybrid resistive switching effect controlled by the conducting channel and interface charge is realized in oxide-based memory devices for low power memory and neuromorphic computing.



TEM image (top left) of the device and 525 distinct memory levels (top right). The bottom panel shows zoomed-in view of the distinct memory levels from three different regions.

Significance and Impact

Development of a novel resistive switching device that shows > 512 distinct memory levels (equivalent to more than 9 bits).

Research Details

- A thin resistive switching layer of sodium bismuth titanate (NBT) was deposited on conducting substrate (Nb:STO) using pulsed laser deposition at CMOS compatible temperature.
- NBT film deposition parameters were controlled to achieve a thin crystalline layer (< 3.5 nm) with an overcoat of thick amorphous layer (8–30 nm).

Work was performed at the Center for Integrated Nanotechnologies.

Xiao, M.; Hellenbrand, M.; Strkalj, N.; Bakhit, B.; Sun, Z.; Barmpatsalos, N.; Joksas, D.; Dou, H.; Hu, Z.; Lu, P.; Karki, S. Ultra-Fast Non-Volatile Resistive Switching Devices with Over 512 Distinct and Stable Levels for Memory and Neuromorphic Computing. *Advanced Functional Materials* 2025.