Roman V. Tominov, Ivan A. Shikhovtsov, Vadim I. Varganov, Ivan S. Ugrumov, Zakhar E. Vakulov, Vadim I. Avilov, Vladimir A. Smirnov

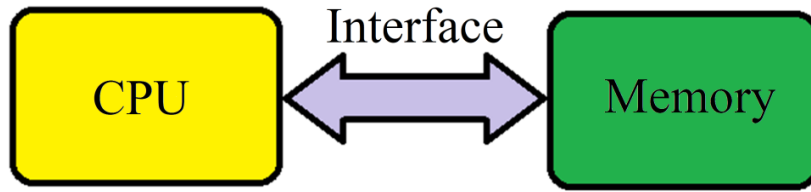**ZnO memristive nanostructures for ReRAM application**

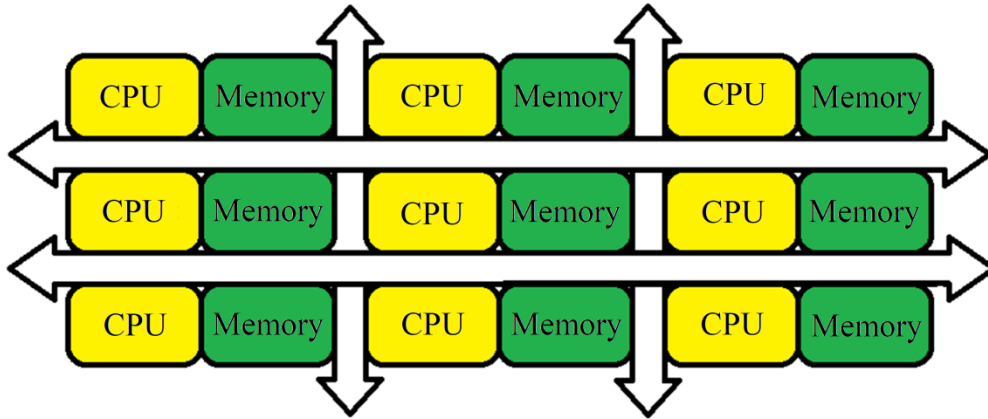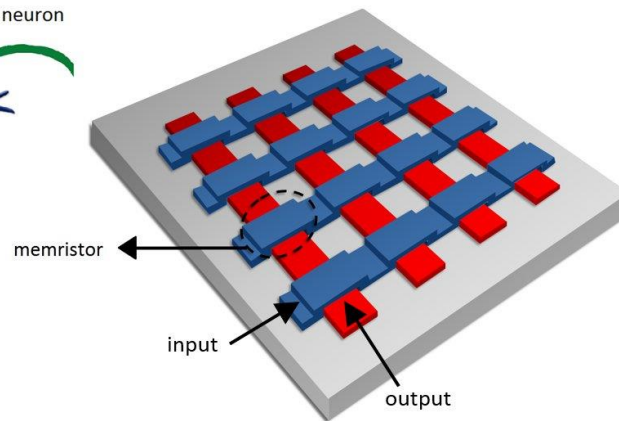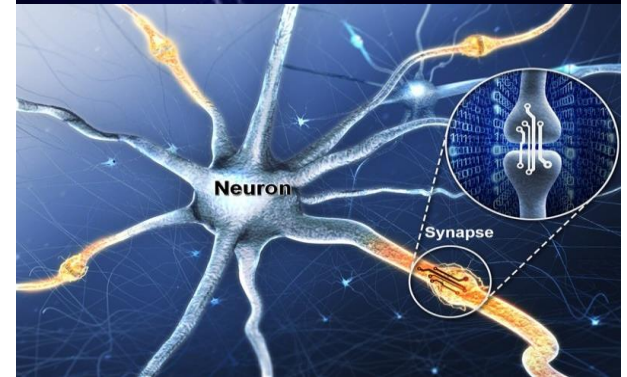Institute of Nanotechnologies, Electronics and Equipment Engineering

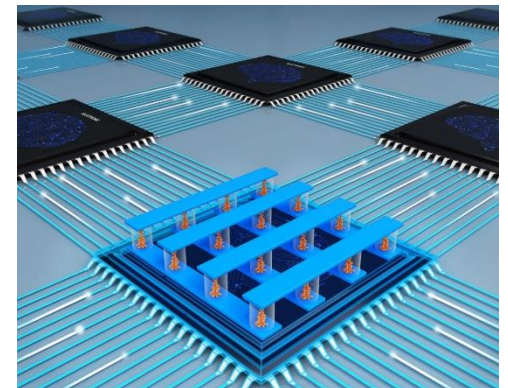nanomaterials

MDPI

Relevance

Von Neumann architecture of computer systems

Neuromorphic architecture of computer systems

Analogy between biological and artificial synapse
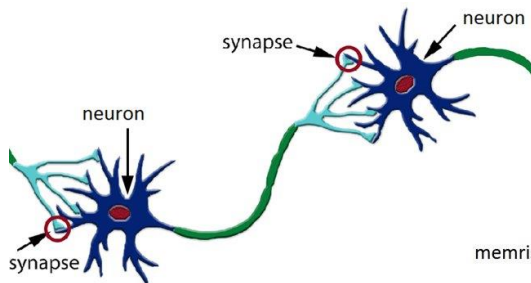
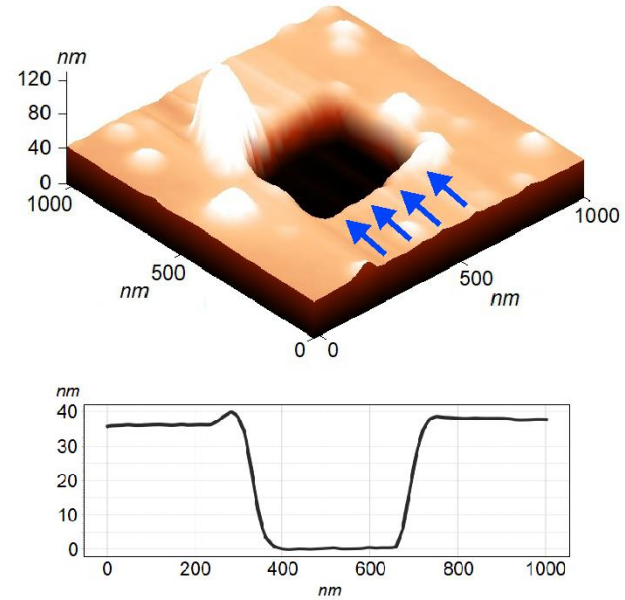**Technical implementation of the neuromorphic system**
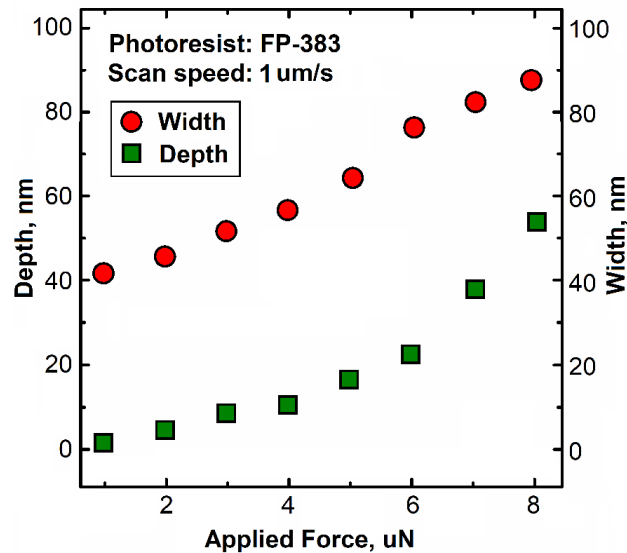

Neuromorphic processor

Study of scratching probe nanolithography modes on FP-383 photoresist:
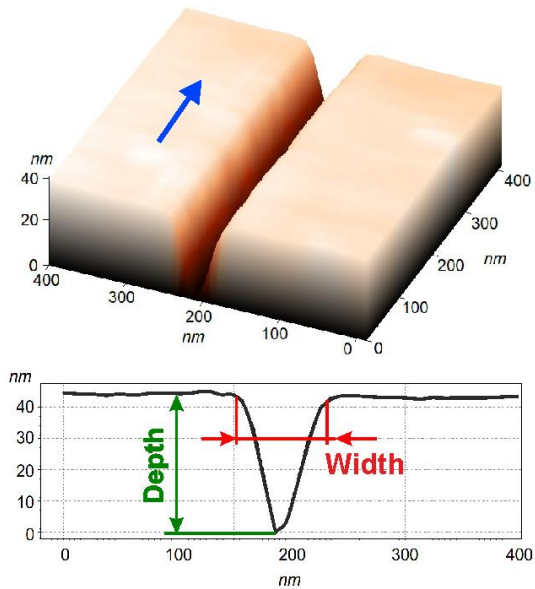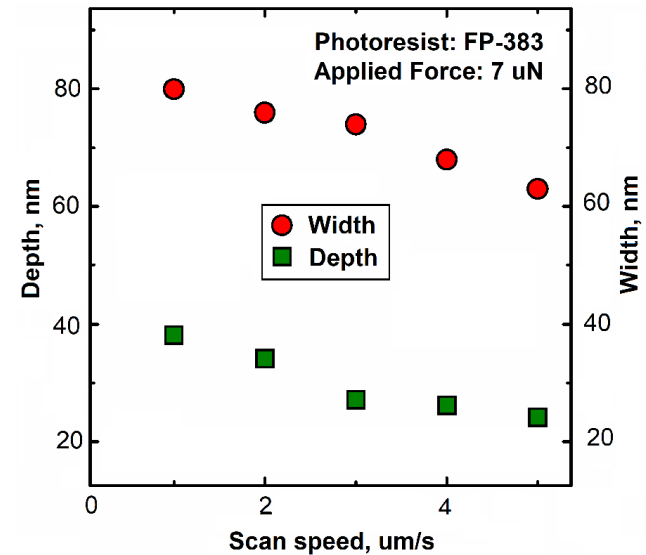

3D-AFM image and AFM cross-section of a single nanostructure

3D-AFM image and AFM cross-section of a complex nanostructure
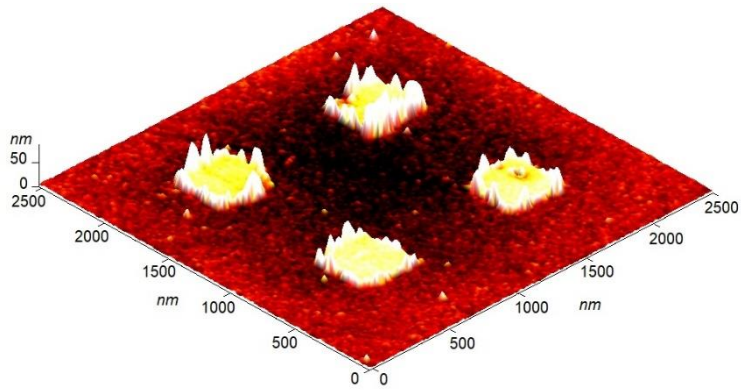

Dependences of the photoresist puncture depth and structure width on the applied force
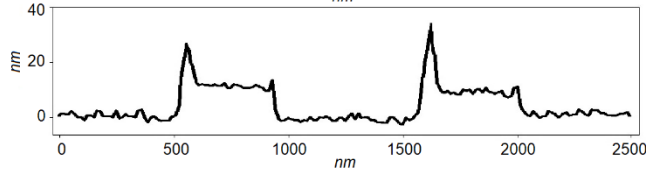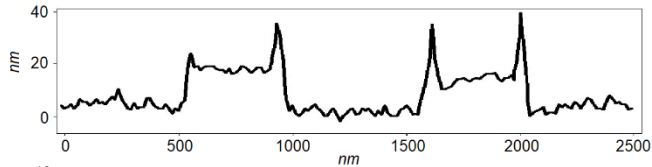

Dependences of the photoresist puncture depth and structure width on the scan speed
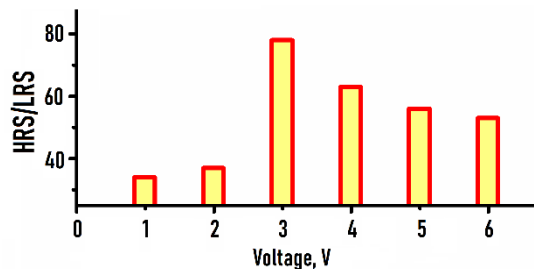
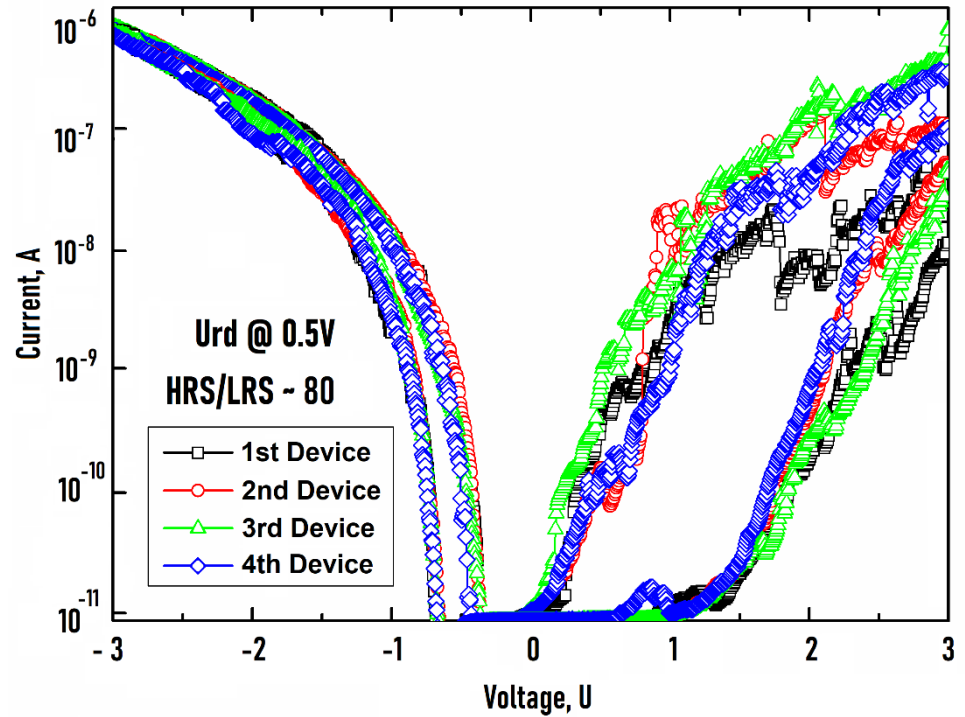# Study of resistive switching of the TiN/ZnO/TiN/Al$_2$O$_3$ structure

3D-AFM image of ZnO film and TiN electrodes

AFM cross-section

HRS/LRS ratio dependence on CVC pulse amplitude (U$_{rd}$ = 0.5V)

Urd @ 0.5V
HRS/LRS ~ 80

- 1st Device
- 2nd Device
- 3rd Device
- 4th Device

Current-voltage characteristics

Retention test

HRS/LRS ratio

Urd@0.5V
HRS
LRS
3rd Device
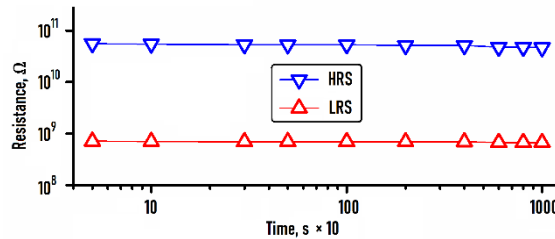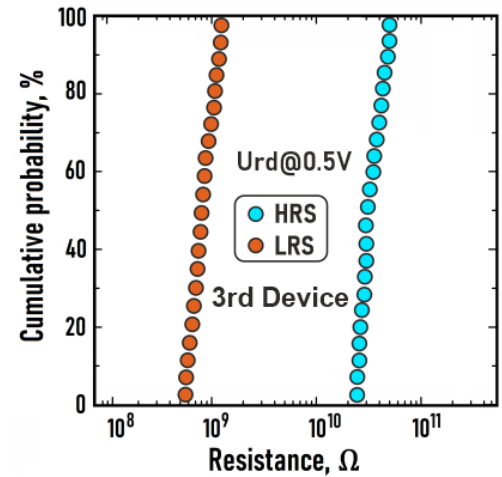
Cumulative probability

4

Conclusion

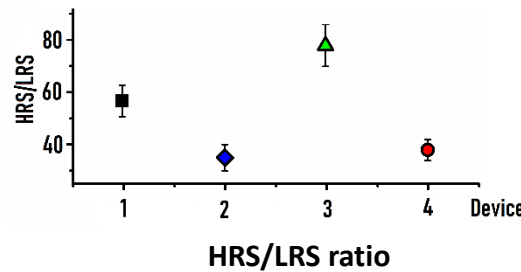In summary, we investigated the scratching probe nanolithography modes, then fabricated and investigated $TiN/ZnO/TiN/Al_2O_3$ ReRAM structures. The devices were shown to exhibit a bipolar resistive switching effect with the HRS/LRS ratio up to 78.8 at reading voltage 0.5 V and maintaining a resistive state up to 10^5 s and more. The results can be useful for micro- and nanoelectronics elements manufacturing, as well as neuromorphic applications using probe nanotechnologies and nanocrystalline ZnO-based ReRAM elements prototyping.

Thank you for attention!