

**IOCN  
2020**

# 2nd International Online- Conference on Nanomaterials

15-30 NOVEMBER 2020 | ONLINE



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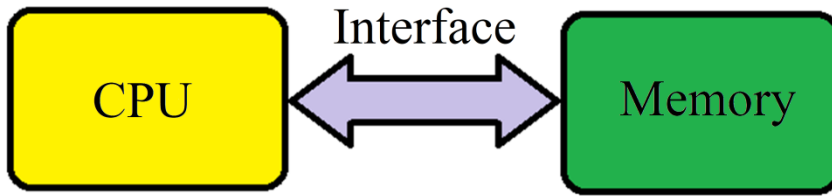
## **SYNTHESIS AND RESISTIVE SWITCHING OF NANOCRYSTALLINE VANADIUM OXIDE FILMS**

Southern federal university  
Institute of Nanotechnologies, Electronics and Equipment Engineering  
Taganrog

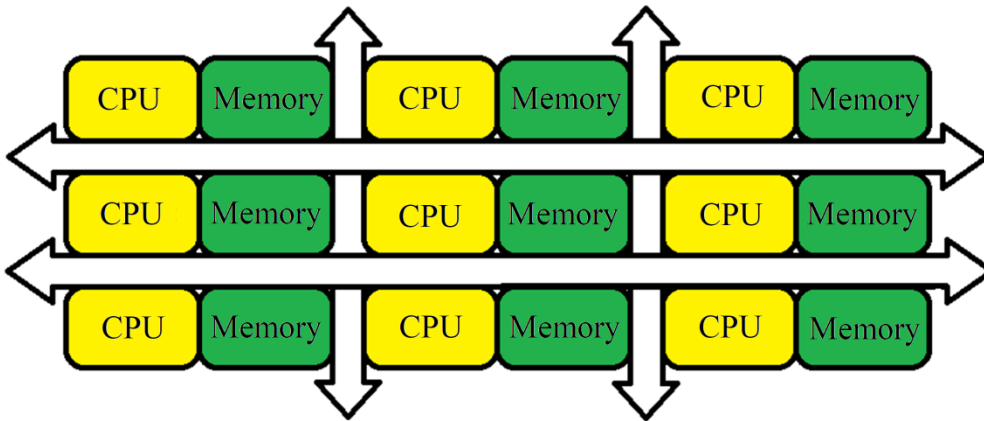


15-30 November

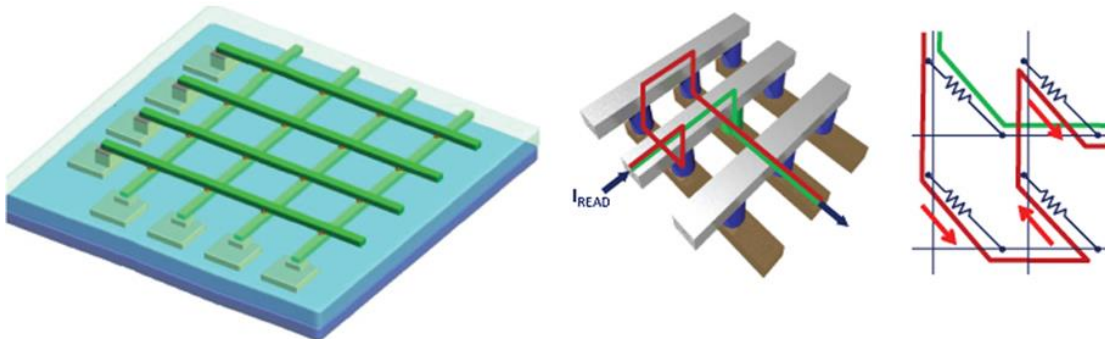
# Relevance



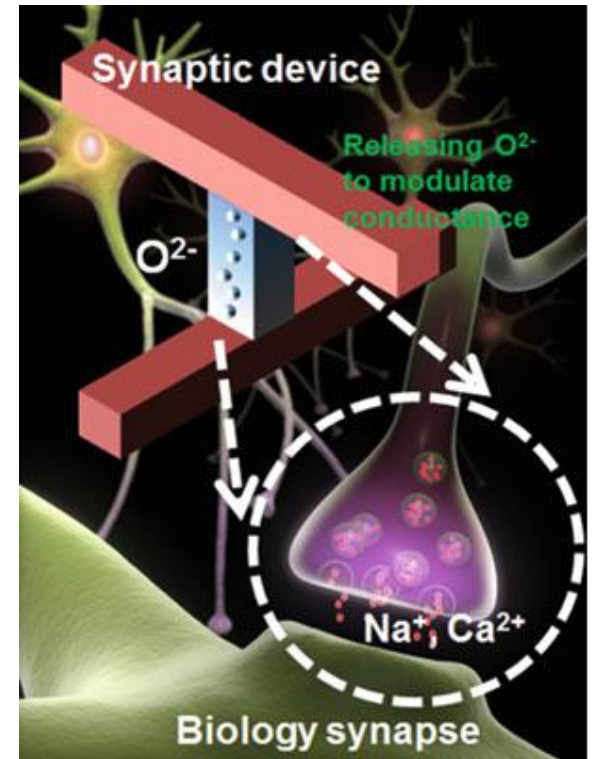
Von Neumann architecture of computer systems



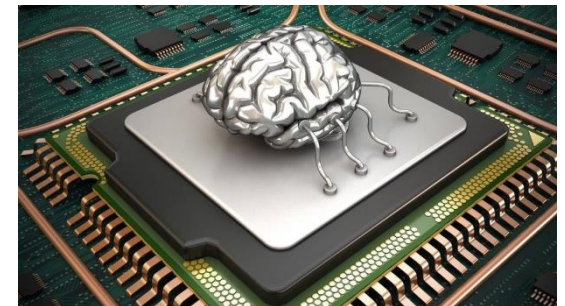
Neuromorphic architecture of computer systems



Technical implementation of the neuromorphic system



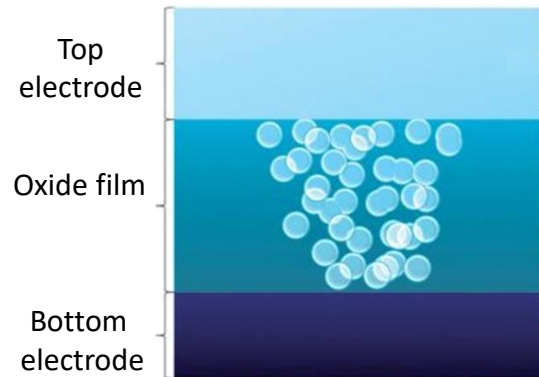
Analogy between biological and artificial synapse



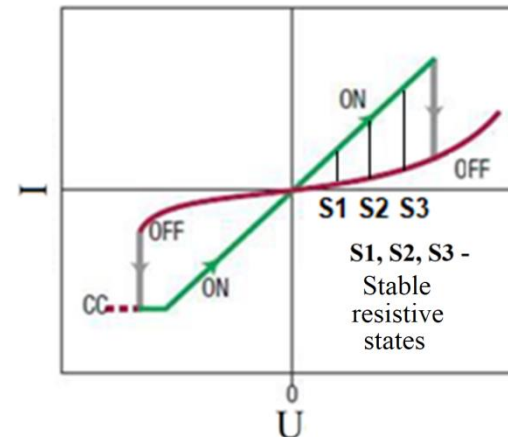
Neuromorphic processor

# A memory for neuromorphic systems

	Traditional memory technologies		Advanced technologies for manufacturing new generation memory			
Memory type	ROM	Flash	FeRAM	MRAM	PRAM	ReRAM
Read time (ns)	200	50	20-50	6-20	8-20	< 5
Writing time (ns)	$10^5/10^7$	$10^5/10^6$	50	10-20	40	< 10
Number of write cycles	$10^5$	$10^3$	$10^{12}$	$10^{15}$	$10^{12}$	$10^{15}$
Reading voltage	High	High	Low	Low	Low	Low
Writing voltage	High	High	Low	High	Low	Low

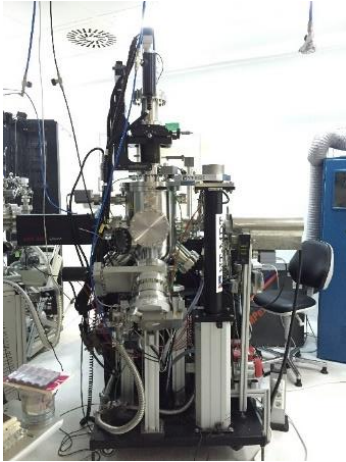


Schematic representation of an element of a neuromorphic processor based on ReRAM

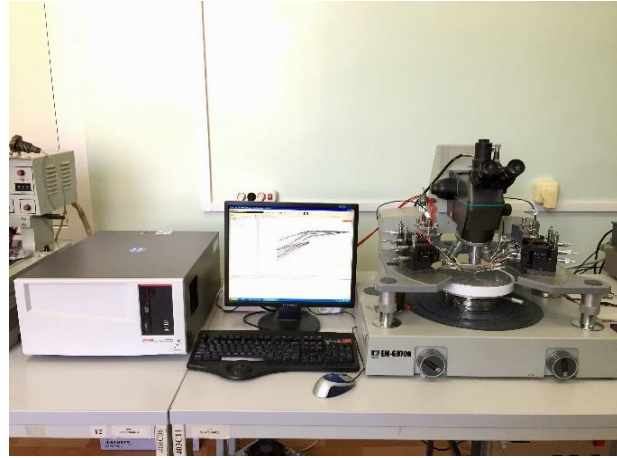


Current-voltage characteristic of ReRAM element

# Equipment



Pioneer 180 pulsed laser deposition system (Neocera, USA)



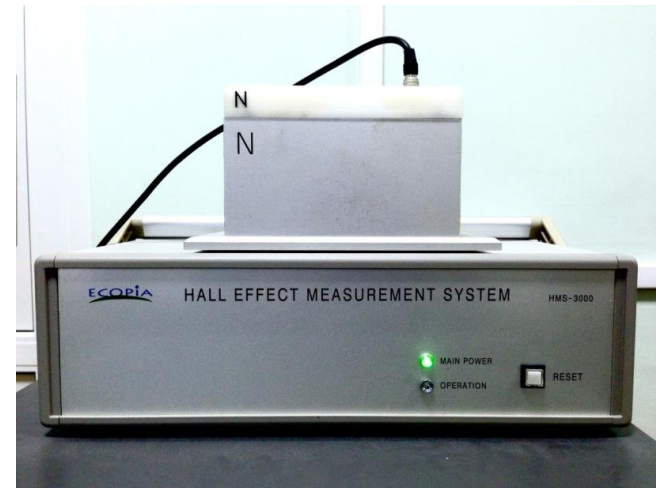
Keithley 4200-SCS Semiconductor Measurement System (Keithley Instruments, USA)



Magnetron sputtering system Auto 500 (BOC Edwards, England)



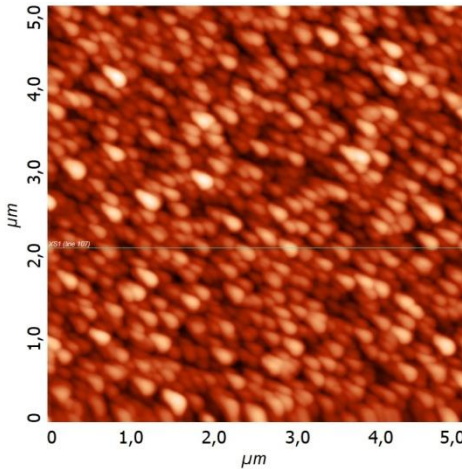
Probe nanolaboratory Ntegra (NT-MDT, Russia)



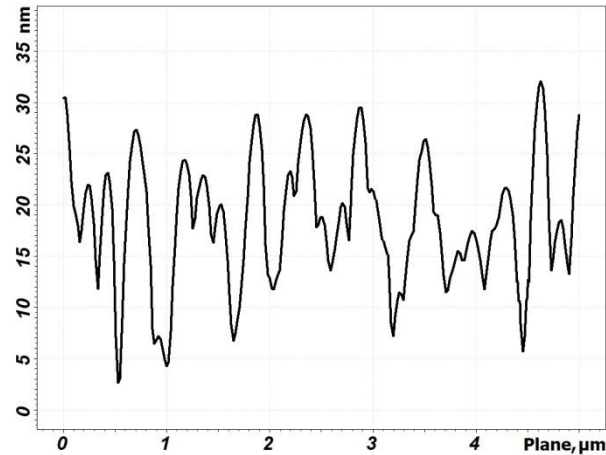
Hall Effect Measurement System Ecopia HMS-3000 (Ecopia Co., Korea)



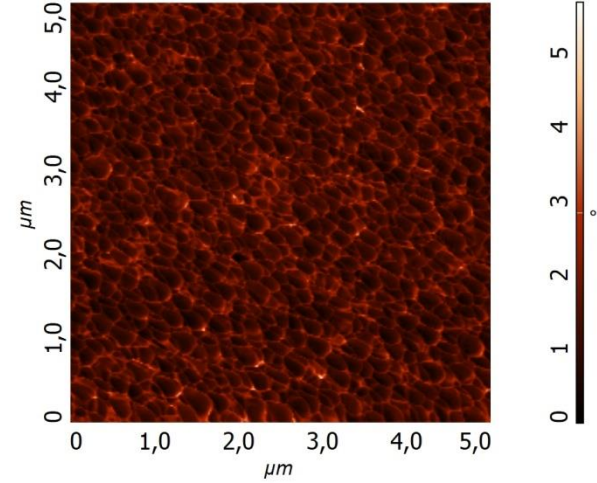
# Experimental studies of the influence of the PLD control parameters on the geometric parameters nanocrystalline vanadium oxide films



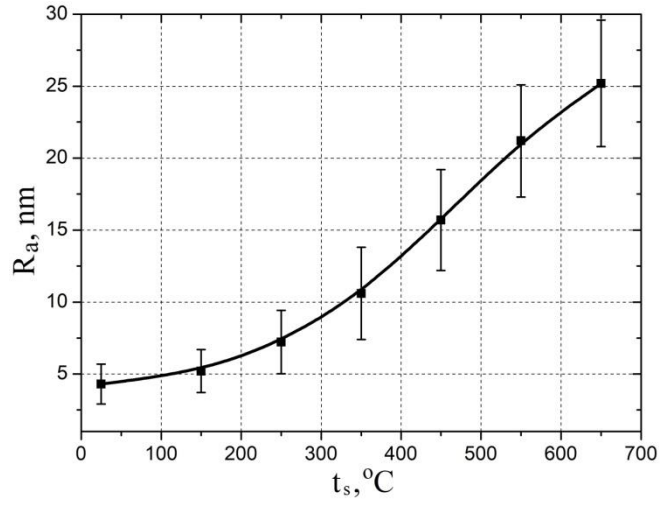
AFM image nanocrystalline oxide vanadium film



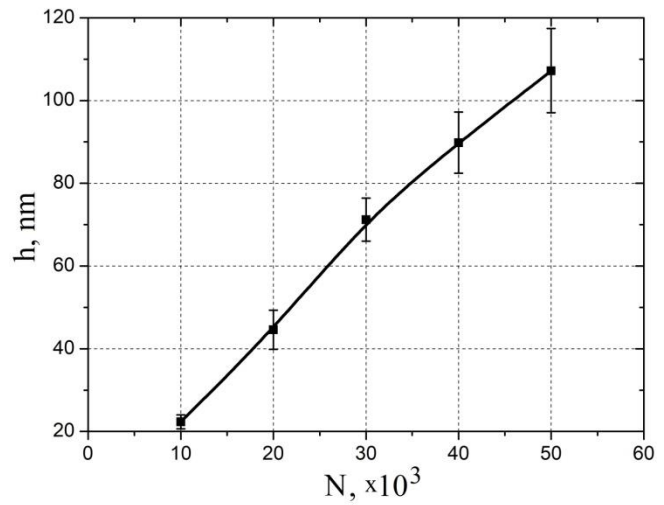
AFM-cross section



Phase

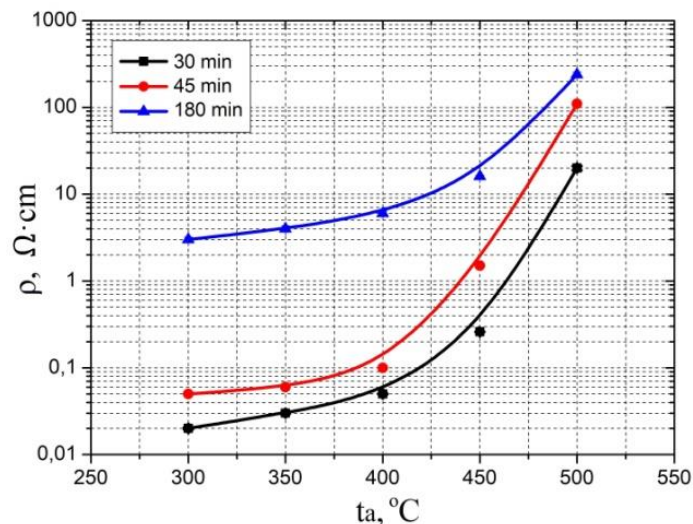


Dependence of the film surface roughness on the substrate temperature

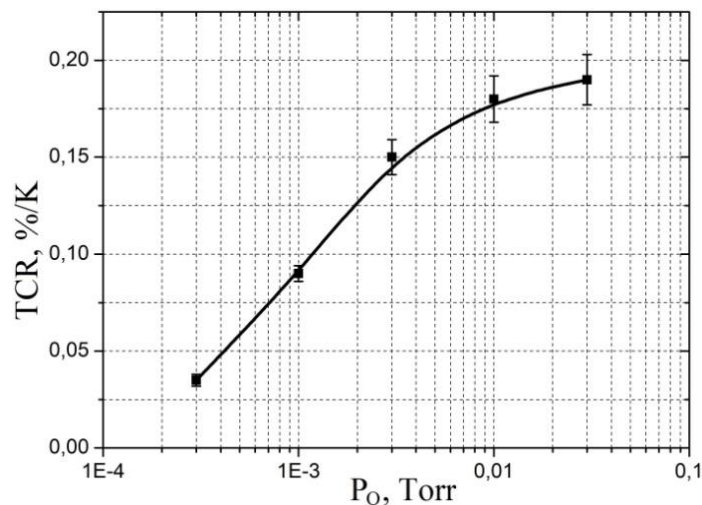


Dependence of the film thickness on the laser pulse number

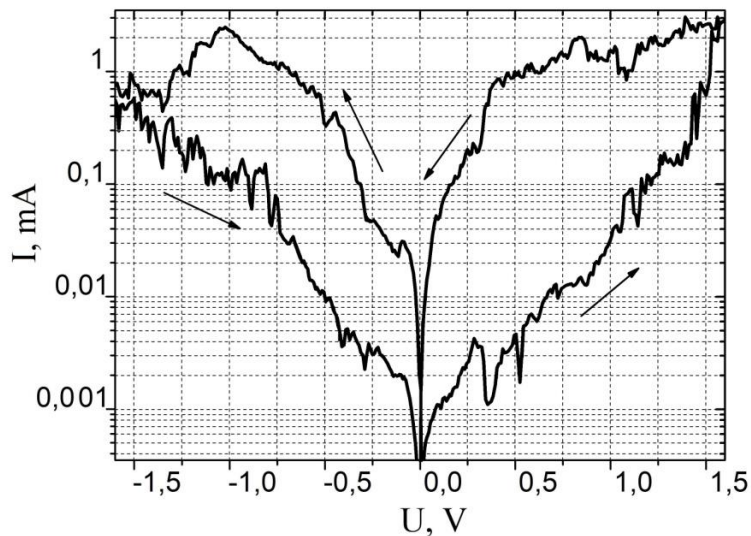
# Experimental studies of the influence of the PLD control parameters on the electrophysical parameters and resistive switching of nanocrystalline vanadium oxide films



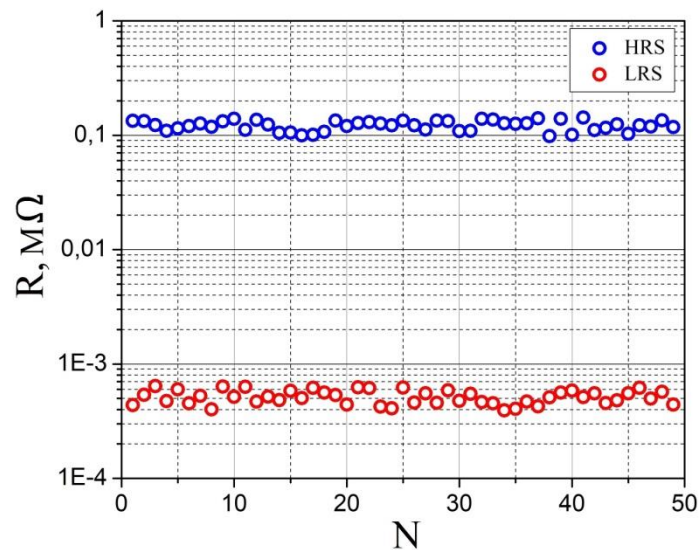
Dependence of the resistivity on annealing temperature at different annealing time



Dependence of the thermal resistance coefficient on an oxygen pressure



Current-voltage characteristic of nanocrystalline vanadium oxide film



Endurance test

*Thank you for attention!*