

Supplementary information

Spike rate dependent synaptic characteristics in lamellar, multilayered alpha-MoO₃ based two-terminal devices - efficient way to control the synaptic amplification

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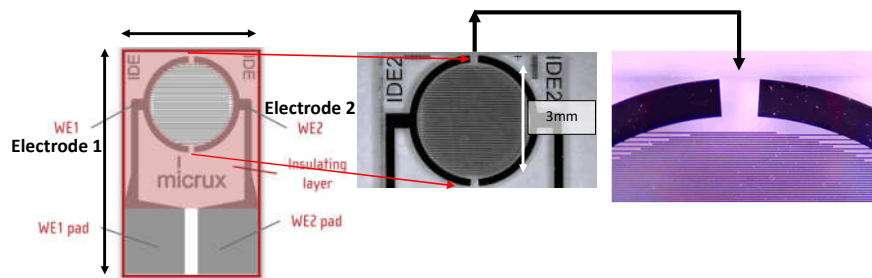


Fig.S1 : The electrode configuration used in the investigation. Interdigitated electrodes from MICRUX TECHNOLOGIES, Mora-Garay Industrial Park, Building #6, Juan de la Cierva, SPAIN were considered. The central area where we drop cast the layered MoO_3 is 3mm in diameter. The electrode system contain 150 pairs of Pt/Ti electrodes with 50 nm Ti wetting layer and then 150 nm of Pt electrode deposited. Each pair of electrodes are separated 5 μm .

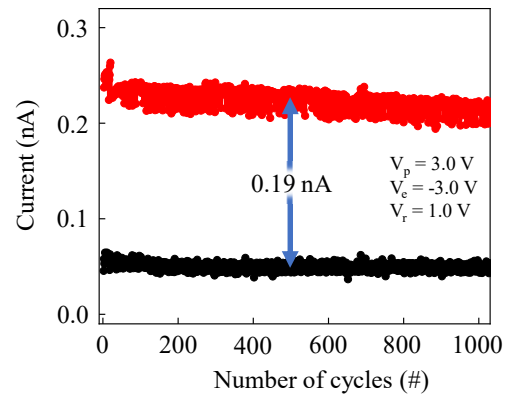


Fig.S2 : Read-Write-Erase statistics for 1000 cycles of operation. Here we applied a write voltage of 3 V and Erase voltage of -3 V. The resistance states are measured at 1 V. The measured current difference between the HRS and LRS state is about 0.19 nA, which amounts to 5.26 GOhm

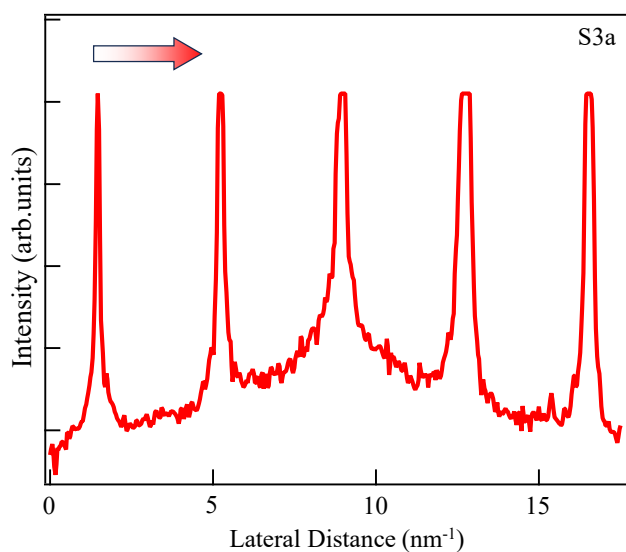
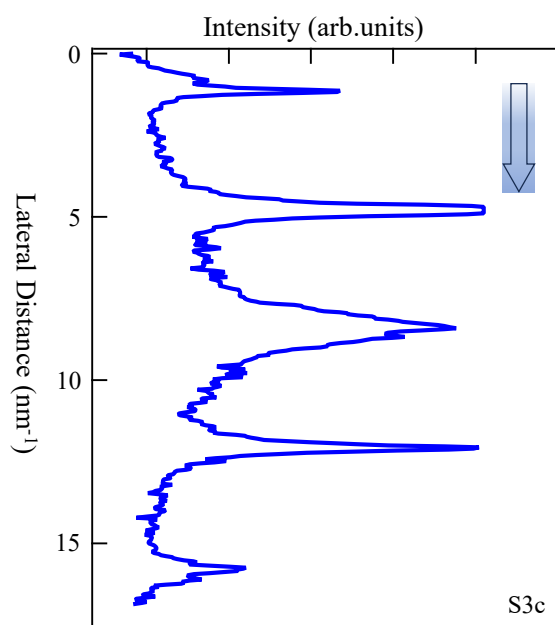
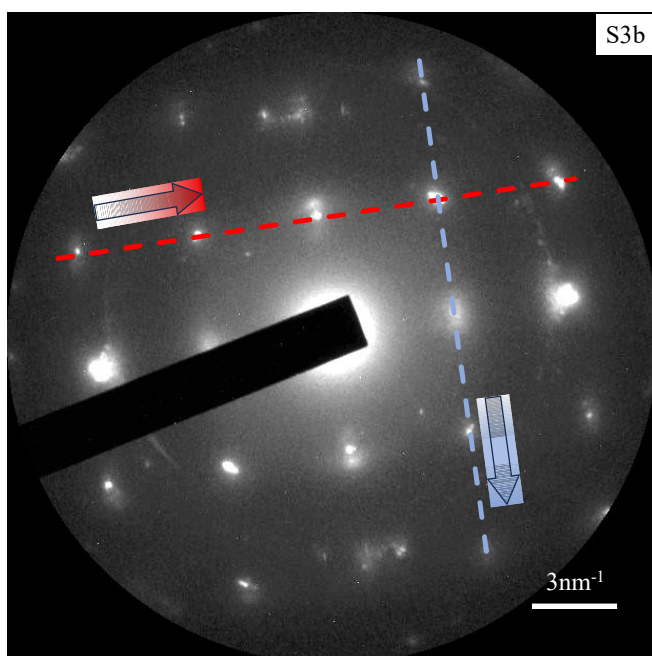


Figure (S3): Detailed analysis of Fourier transform image of the transmission electron microscopy image showing fig.(1h). (S3a) represent the line scan of the intensity along (-1,1) to (1,1) direction as shown by the red dashed line in S3b. The average distance between the peaks along this direction is 0.266 nm. (S3c) shows the intensity profile along (1,1) to (1,-1) direction as shown by the blue dotted curve in fig(S1b). The average distance between the peaks along this direction is 0.274 nm.



Along (-1,1) to (1,1) direction

Total distance from point A to point B in the intensity profile (in S2a) : $\Delta x = 14.499 \text{ nm}^{-1}$

Average distance of separation : $\frac{14.499 \text{ nm}^{-1}}{4} = 3.62475 \text{ nm}^{-1}$

The average distance in real lattice : $\frac{1}{3.62475 \text{ nm}^{-1}} = 0.276 \text{ nm}$

Along (1,1) to (1,-1) direction

Total distance from point B to point C in the intensity profile (in S2c) : $\Delta y = 14.608 \text{ nm}^{-1}$

Average distance of separation : $\frac{14.608 \text{ nm}^{-1}}{4} = 3.652 \text{ nm}^{-1}$

The average distance in real lattice : $\frac{1}{3.652 \text{ nm}^{-1}} = 0.274 \text{ nm}$

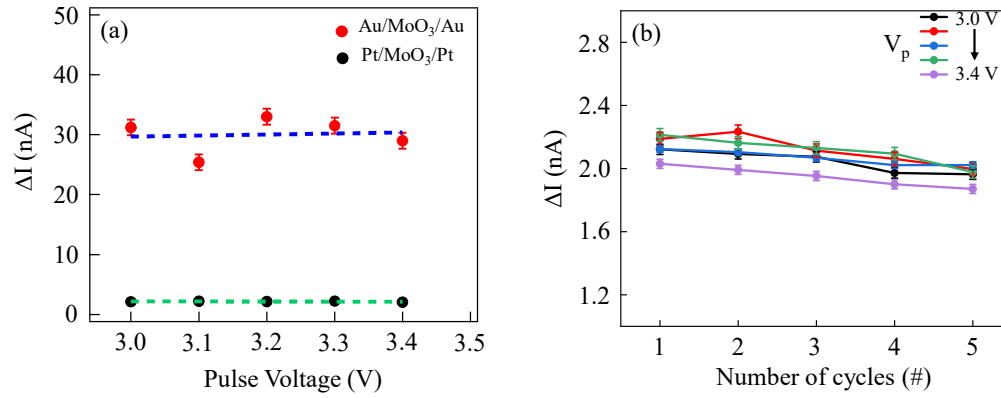


Figure (S4) : (a) The pulse voltage dependence of the potentiation in Pt/MoO₃/Pt (Black) and Au/MoO₃/Au (Red) devices. The data points show the change in the post synaptic current (ΔI) during the potentiation. The change in the PSC is independent of the pulse voltages used. (b) The absolute change in the post-synaptic current with number of cycles. Post-synaptic current change is also plotted for various pulse voltage used to measure the potentiation and depression.