

SUPPLEMENTARY INFORMATION

Laser-reconfigured MoS₂/ZnO Van Der Waals Synapse

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Fig. S1

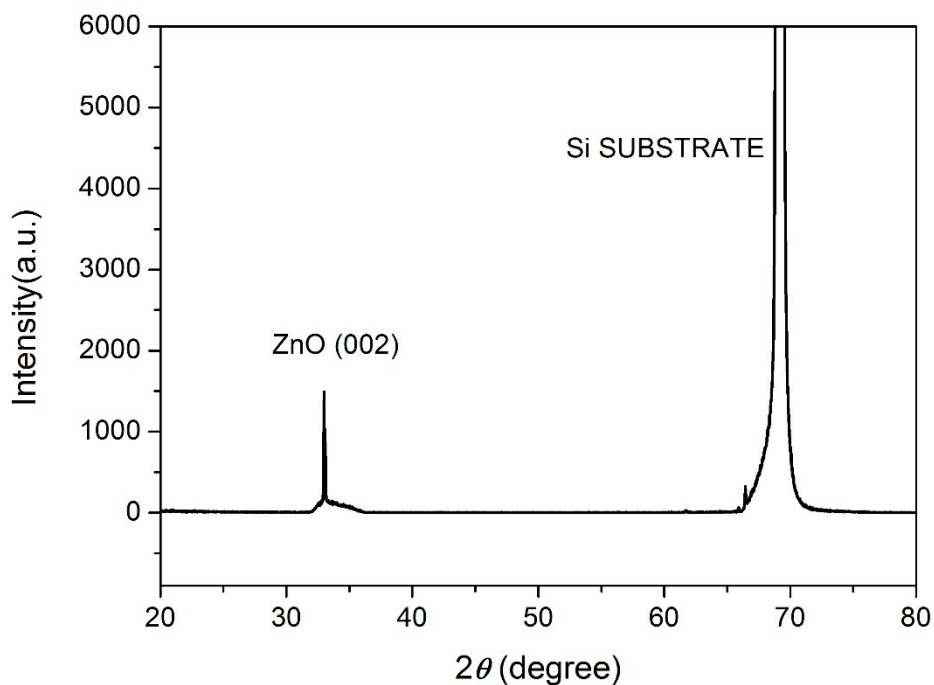


FIG. S1 is a spectrum showing crystal orientations of an X-ray diffraction (XRD) analysis of a ZnO formed using sputtering.

Fig. S2

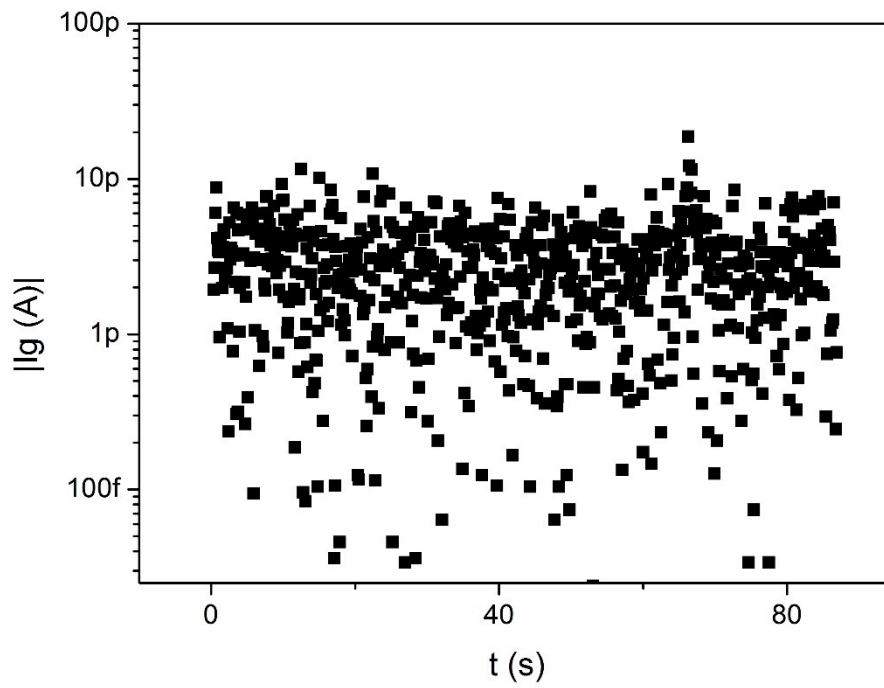


FIG. S2 The leakage current I_g .

The leakage current of buried gate is lower than 10^{-12} A, approximately.

Fig. S3

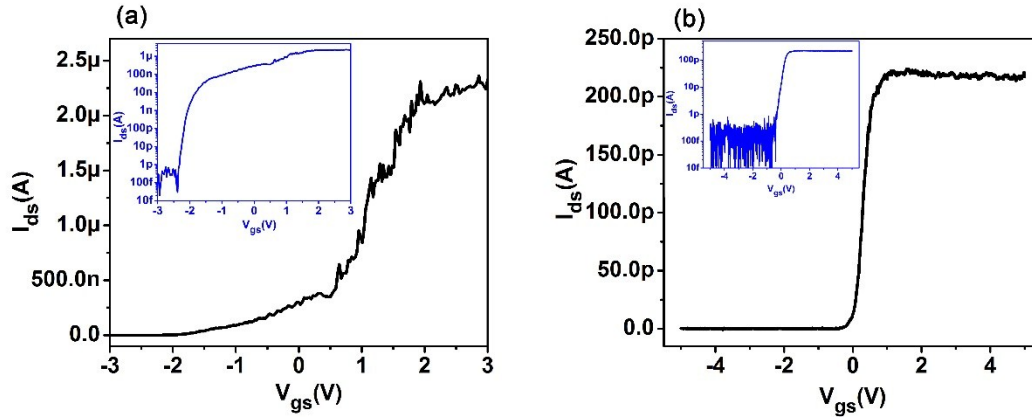


FIG. S3 The transfer curves. (a)the individual MoS₂. (b) the individual ZnO.

We fabricated and tested the device of individual MoS₂ and ZnO. The electrical characterizations are shown in Supplementary Figure 3a and 3b. The on/off ratio are 10^6 and 10^3 , respectively. The threshold voltage are -1 V and 0 V, respectively.

Fig. S4

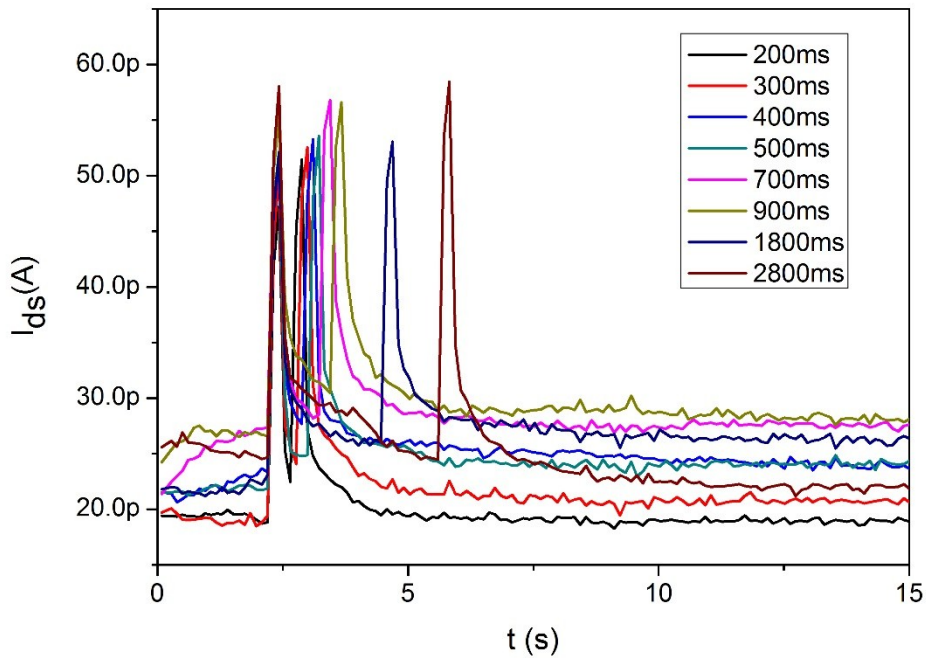


Fig. S4 The I_{ds} triggered by a pair of presynaptic pulses with different interval time (Δt).

A spike of postsynaptic current was generated by a presynaptic spike (3 V, 200 ms). If two presynaptic spikes are close enough, the I_{ds} generated by the second presynaptic spike will be enhanced, which can be used to mimic paired-pulse facilitation (PPF) in the neuroscience. As shown in Fig. S4, the amplitude of the I_{ds} peak value generated by the second presynaptic pulse is larger than that of the first one. And the longer the interval time between two presynaptic spikes is, the lower ratio will be.

Fig. S5

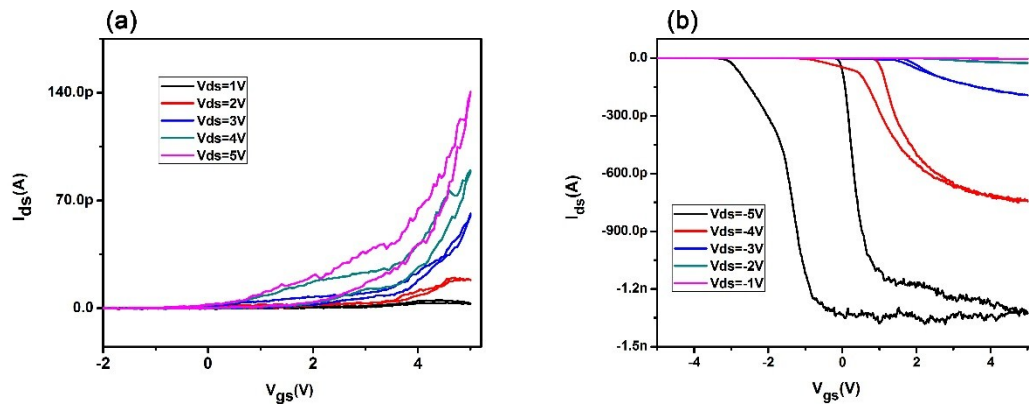


Fig. S5 The transfer characteristics of the transistors. (a) $V_{ds} = 5$ V (b) $V_{ds} = -5$ V.

The transfer characteristics of the transistors with different drain voltages were shown in the Supplementary Figure 5. As is shown in the picture, the I_{ds} and hysteresis loop increases with the increase of voltage amplitude.

Fig. S6

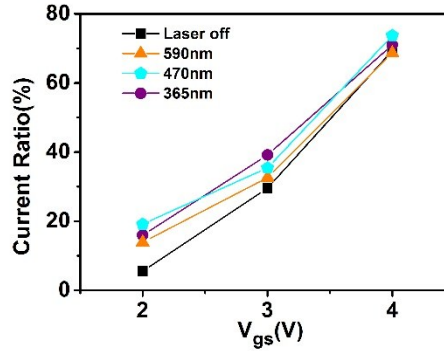


Fig. S6 The PSC current ratio under different illumination conditions. Current ratio = $((I - I_0)/I_0) \times 100\%$. I is the initial drain current after the gate voltage pulse stimulation. I_0 is the base current before the pulse.

Table S1. When $\Delta t = 200$ ms, the PPF ratio of MoS₂/ZnO Van Der Waals synapse and other two-terminal artificial synapse.

	Ratio ($\Delta t = 200$ ms)
MoS ₂ /ZnO synapse	15%
organic thin film memristors (Ref.36)	6%
tungsten-oxide (WO _x) memristor (Ref.37)	<1%
Ta/TaO _x /TiO ₂ /Ti device (Ref.38)	4%

According to the comparison, the PPF ratio of MoS₂/ZnO synapse is larger than two-terminal artificial synapse. Compared with other devices, we can get more obvious PPF at the same time interval.

- S1. Y.-N. Zhong, T. Wang, X. Gao, J.-L. Xu and S.-D. Wang, *Advanced Functional Materials*, 2018, **28**, 1800854.
- S2. T. Chang, P. Sheridan and W. Lu, 2012.
- S3. Y.-F. Wang, Y.-C. Lin, I. T. Wang, T.-P. Lin and T.-H. Hou, *Scientific Reports*, 2015, **5**, 10150.