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Electronic Supporting Information

Solvent-assisted sulfur vacancy engineering method in MoS_2 for neuromorphic synaptic memristor

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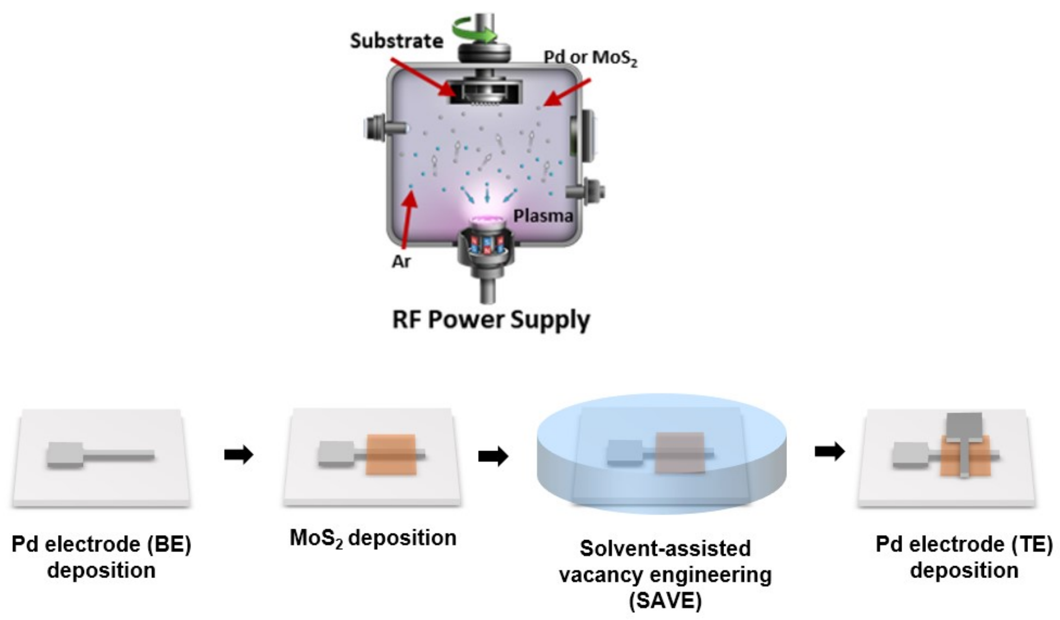

Fig. S1 An illustration of the MoS_2 thin film deposition and synaptic memristor ($Pd/MoS_2/Pd$) fabrication process.

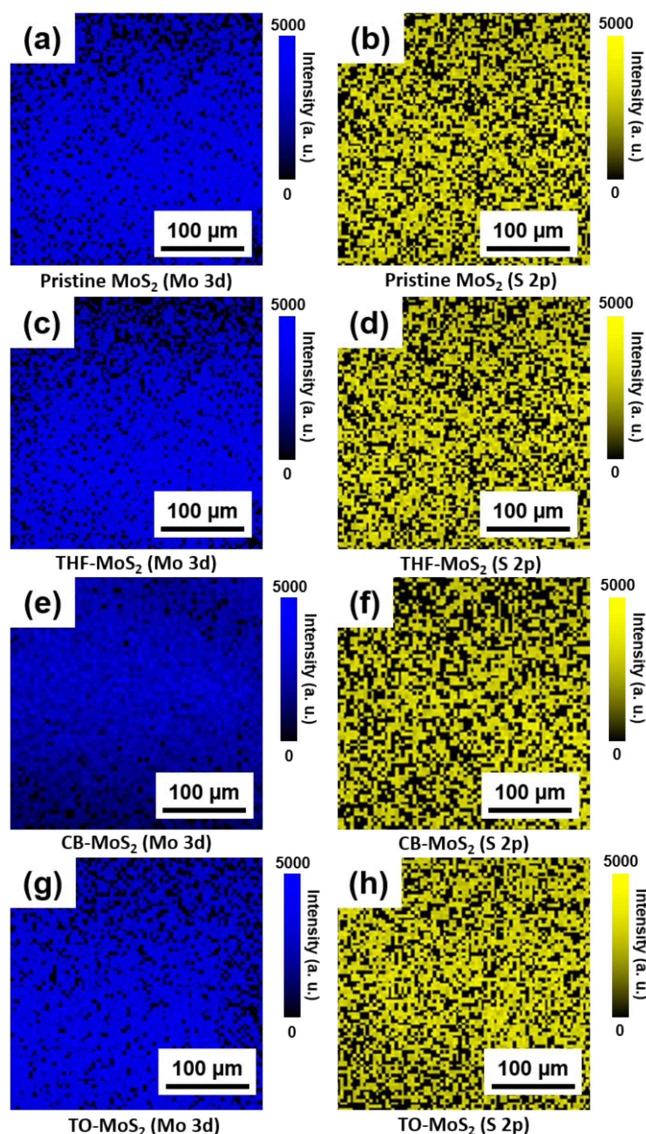

Fig. S2 Energy-dispersive X-ray spectroscopy (EDX) mapping (300 μm × 300 μm) to confirm the surface film quality and uniformity of the Mo and S atoms. (a) Pristine-MoS_2 (Mo 3d), (b) pristine-MoS_2 (S 2p), (c) THF-MoS_2 (Mo 3d), (d) THF-MoS_2 (S 2p), (e) CB-MoS_2 (Mo 3d), (f) CB-MoS_2 (S 2p), (g) TO-MoS_2 (Mo 3d), and (h) TO-MoS_2 (S 2p)

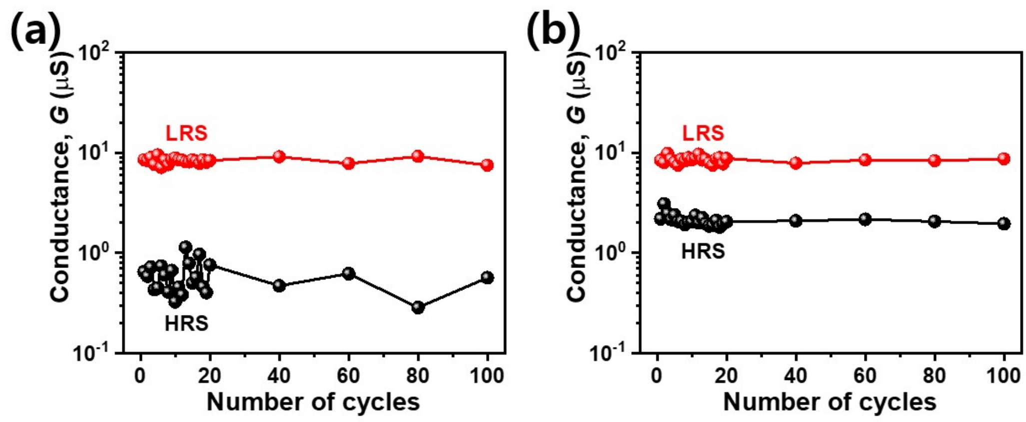

Fig. S3 The measured conductance of (a) CB-MoS_2 and (b) TO- MoS_2 synaptic memristor at HRS and LRS maintained for 100 cycles.

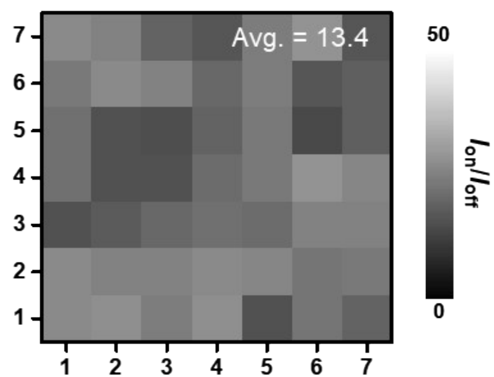

Fig. S4 I_{on}/I_{off} mapping image of 49 THF-MoS_2 memristors.

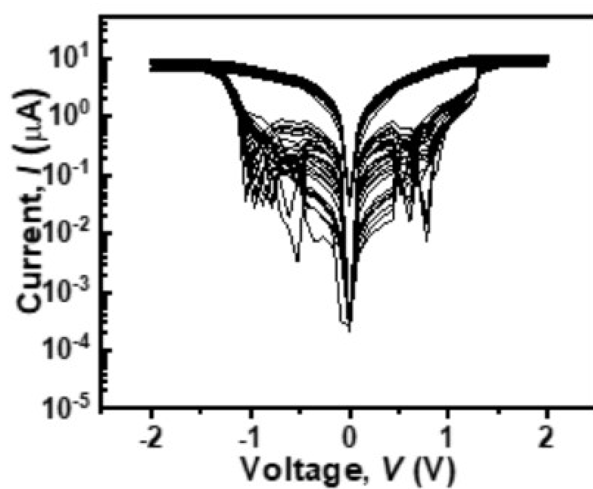

Fig. S5 30 cycles *I-V* repeatability test of THF-MoS_2 memristor.

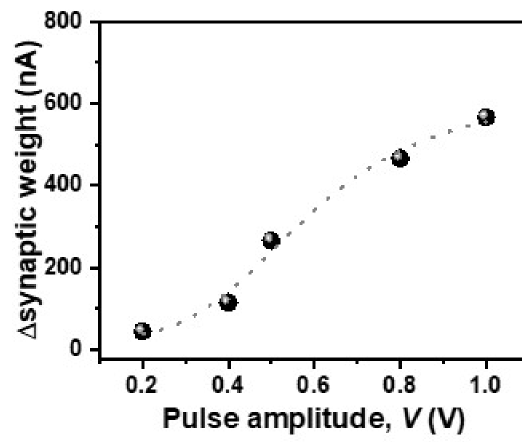

Fig. S6 Synaptic weight change depending on pulse amplitudes.

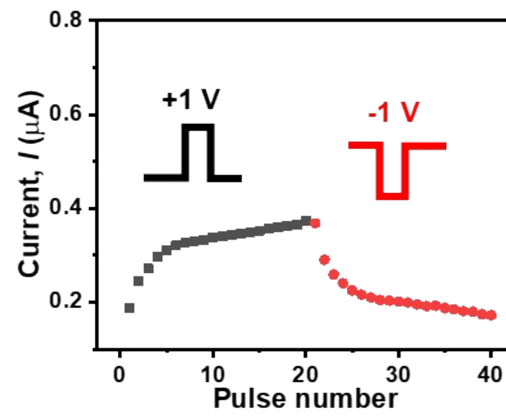

Fig. S7 Long-term potentiation and long-term depression pristine MoS_2 memristor (V_{LTP} = +1 V for 20 ms, V_{LTD} = -1 V for 20 ms).

	MoS_2	Tetrahydrofuran (THF)	Chlorobenzene (CB)	Toluene (TO)
HSP (MPa^{-1})	18.54-24.02	19.46	19.58	18.16

Table S1 Hansen solubility parameters (HSPs) of MoS_2, tetrahydrofuran (THF), chlorobenzene (CB), and toluene (TO)

	Tetrahydrofuran (THF)	Chlorobenzene (CB)	Toluene (TO)
Polarity index	4.0	2.7	2.4

Table S2 Polarity index of tetrahydrofuran (THF), chlorobenzene (CB), and toluene (TO)

	Tetrahydrofuran (THF)	**Chlorobenzene (CB)**	**Toluene (TO)**
I_{on}/I_{off}	1.38×10^2	1.67×10^2	7.69×10^1
V_{SET} (V_{RESET}) [V]	1.25 ± 0.21 (-1.36 ± 0.23)	1.78 ± 0.29 (-1.41 ± 0.25)	1.53 ± 0.25 (-1.58 ± 0.21)

Table S3 V_{SET}, V_{RESET} and I_{on}/I_{off} of THF-MoS_2, CB-MoS_2, TO-MoS_2 synaptic memristor.

Pulse # / **Normalized current**	**#3**	**#10**	**#18**
LTP	0.49	0.77	0.96
LTD	0.82	0.51	0.30

Table S4 Normalized current values in potentiation and depression depending on pulse number.