

Supplementary Information:

Low voltage and high ON/OFF ratio field-effect transistors based on CVD MoS₂ and ultra high-*k* PZT gate dielectric

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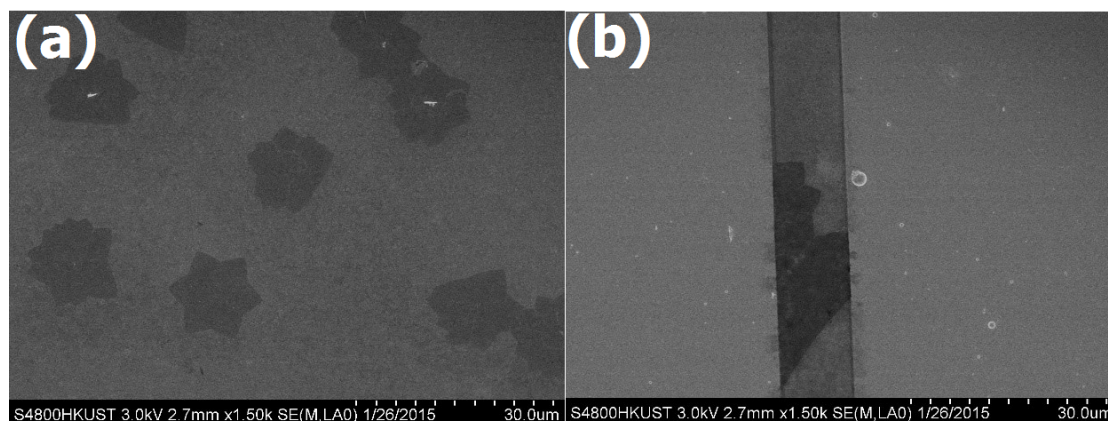


Fig. S1 SEM pictures of the transferred MoS₂ flakes on the PZT substrate. (a) Some triangular MoS₂ flakes are merged during the growth. (b) A typical device with Au/Ti electrodes on a MoS₂ flake.

We have fabricated PZT gated MoS₂ transistors with different channel dimensions and presented the transfer characteristics of several devices as following:

- Electrical characteristics of MoS₂ transistor with $L = 2 \mu\text{m}$ and $W = 20 \mu\text{m}$. For this device, $V_T = 0.2 \text{ V}$, $SS = 104 \text{ mV/dec}$, and $\mu = 10.01 \text{ cm}^2/\text{V}\cdot\text{s}$.

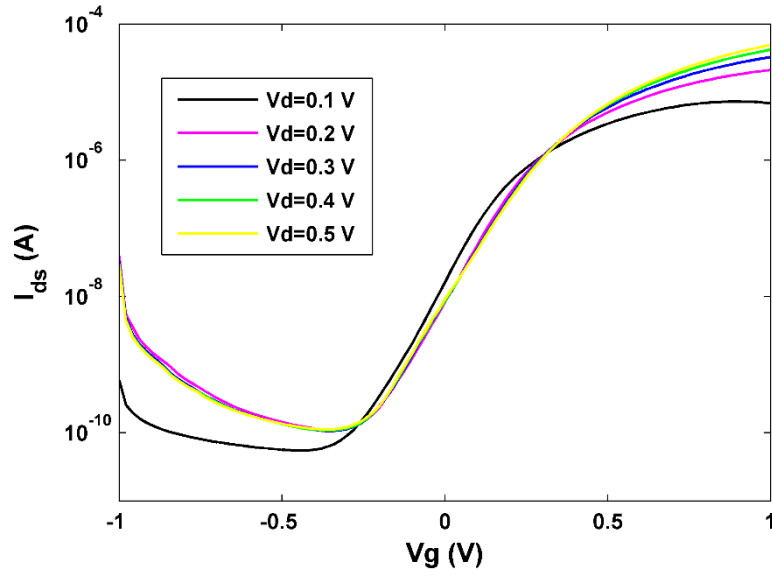


Fig. S2 Transfer characteristics of a MoS₂ transistor with L= 2 μm and W= 20 μm.

- b) MoS₂ transistor with L= 4 μm and W= 5 μm. For this device, $V_T=0.41$ V, SS= 109 mV/dec, and $\mu=6.19$ cm²/V·s.

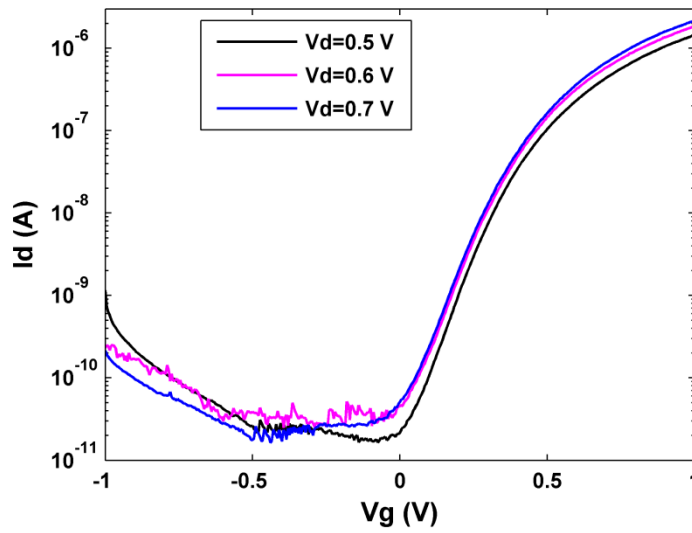


Fig. S3 Transfer characteristics of a MoS₂ transistor with L= 4 μm and W= 5 μm.

- c) Electrical characteristics of MoS₂ transistor with L= 4 μm and W= 20 μm. For this device, $V_T=0.32$ V, SS= 99 mV/dec, and $\mu=3.92$ cm²/V·s.

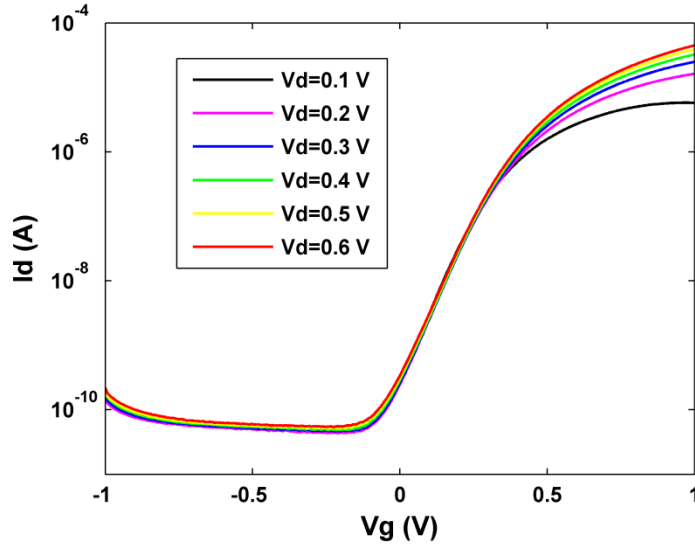


Fig. S4 Transfer characteristics of a MoS₂ transistor with L= 4 μ m and W= 20 μ m.

As a reference, the MoS₂ flakes were transferred to a SiO₂/Si substrate for transistor fabrication and characterization. Fig. S5 shows the transfer characteristics of a MoS₂ transistor with L= 2 μ m and W= 100 μ m. Fig. S6 shows the hysteresis behavior of the same device. All the electrical characterization was conducted at 300 K in a vacuum probe station.

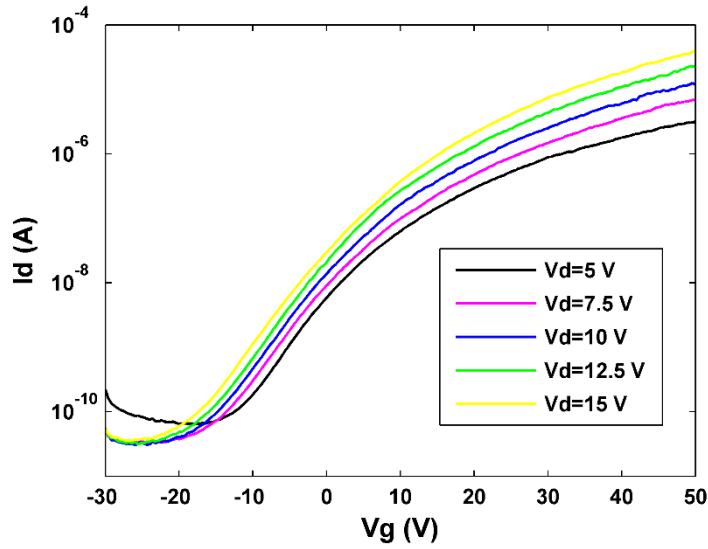


Fig. S5 Transfer characteristics of a 300 nm SiO₂ gated MoS₂ transistor with L= 2 μ m and W= 100 μ m.

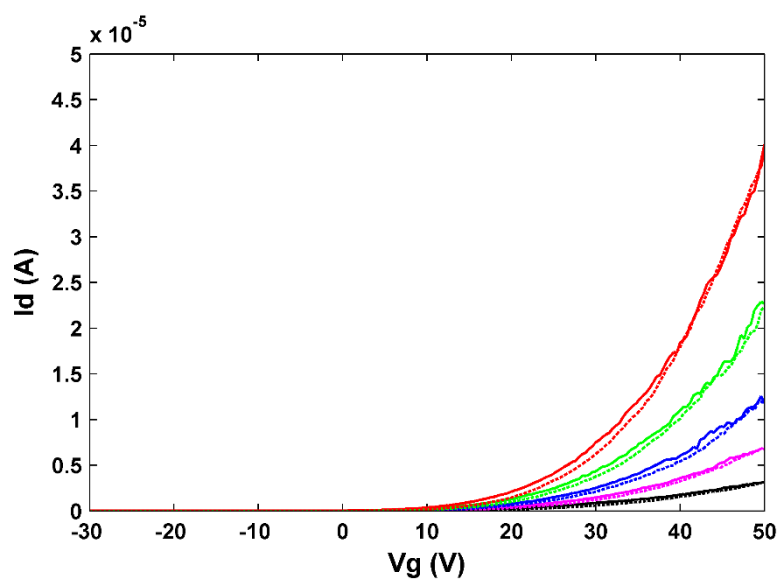


Fig. S6 Hysteresis characteristics of a 300 nm SiO_2 gated MoS_2 transistor with $L=2$ μm and $W=100$ μm .