

Supporting Information

Optimized single-layer MoS₂ field effect transistors by non-covalent functionalisation

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Thicknesses of Al₂O₃ of top-gated FETs

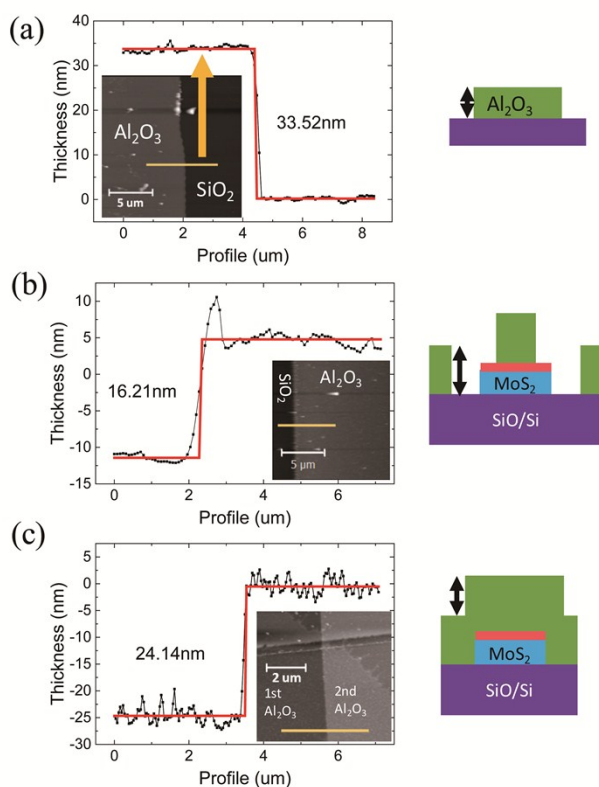


Figure S1. (a) AFM height profile of ALD- Al_2O_3 of device type 1. (b) AFM height profile after the first ALD- Al_2O_3 deposition, (After Al_2O_3 etch (Figure 5(a) step 3 and an additional removal of the PMMA) of device type 2. (c) AFM height profile after second ALD- Al_2O_3 deposition of device type 2.

Back-gated CVD MoS_2 FETs

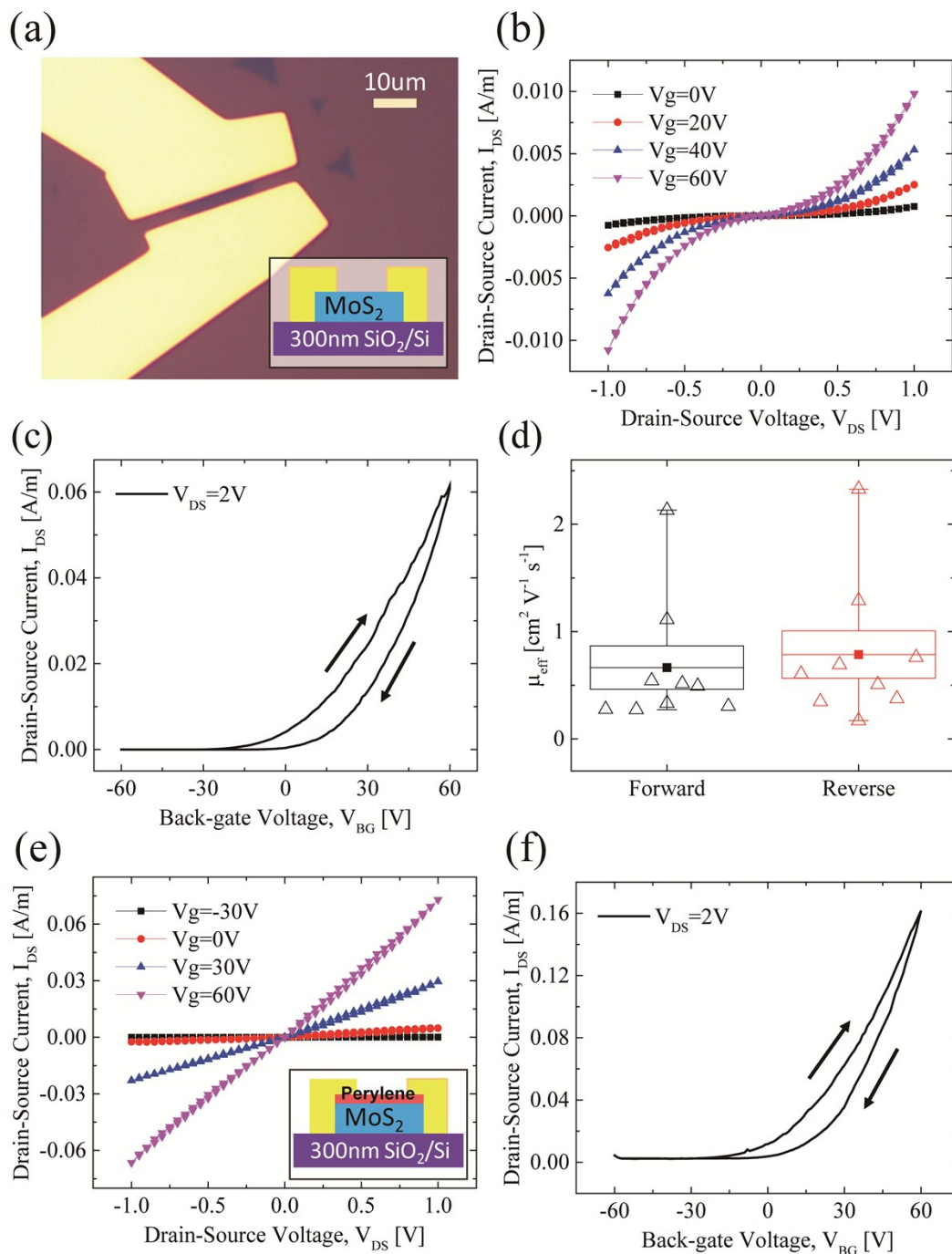


Figure S2. (a) Optical image of a back-gated CVD MoS_2 FET. The inset shows schematic of the device. (b) Output characteristics of the device shown in (a). (c) Transfer characteristics for the back-gated bias range of ± 60 V at $V_{\text{DS}} = 2$ V of the device. (d) Distribution of field-effect mobilities for forward sweep (black) and reverse sweep (red), this was extracted from nine devices. Open triangles

denote the data for each sample. Filled squares denote the average of nine samples. Boxes correspond to the standard error of samples. (e) Output characteristics of a back-gated CVD MoS₂ FET with functionalisation. (f) Transfer characteristics of the device with functionalized MoS₂.

Figure S2(b) shows the I_{DS} - V_{DS} output characteristics at various back-gate voltages (V_{BG}). Figure S2(c) shows the typical shapes of I_{DS} - V_{GS} transfer characteristics with clockwise hysteresis. In figure S2(d), the average field-effect mobility of the devices is shown to be 0.664 cm²/Vs for forward sweep and 0.786 cm²/Vs for reverse sweep. Figure S2(e) and (f) show the electrical characteristics of back-gated CVD MoS₂ FET with functionalisation by perylene bisimide. Perylene bisimide was deposited before patterning of source/drain electrodes on MoS₂. Except for the functionalisation, all other fabrication processes are the same as the back-gated MoS₂ FET of figure S2(a) – (d). For the back-gated device with functionalisation, figure S2(f) shows a similar clockwise hysteresis like figure S2(c). From the electrical characteristics of the back-gated FETs it is reasonable to infer that perylene bisimide does not significantly affect the hysteresis between MoS₂ and electrodes.