Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Transport properties of the top and bottom surfaces in monolayer MoS_2 grown by chemical vapor deposition

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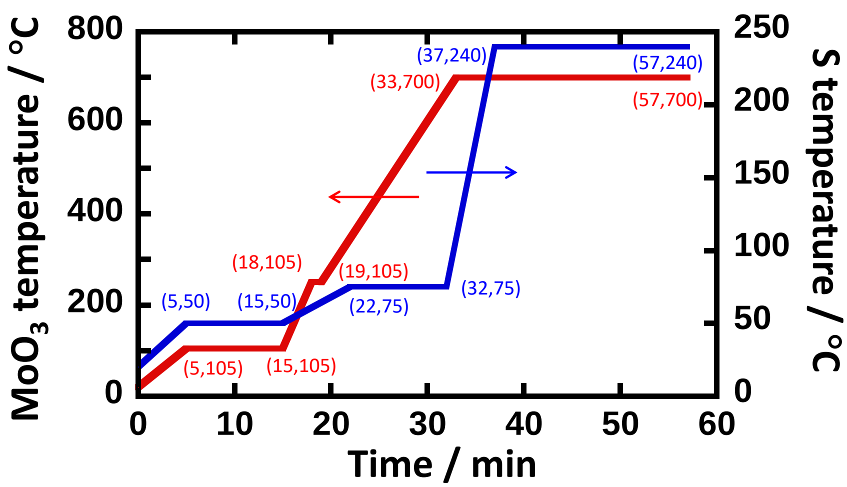

Figure S1: The program set up for the temperatures of MoO_3 and S powders.

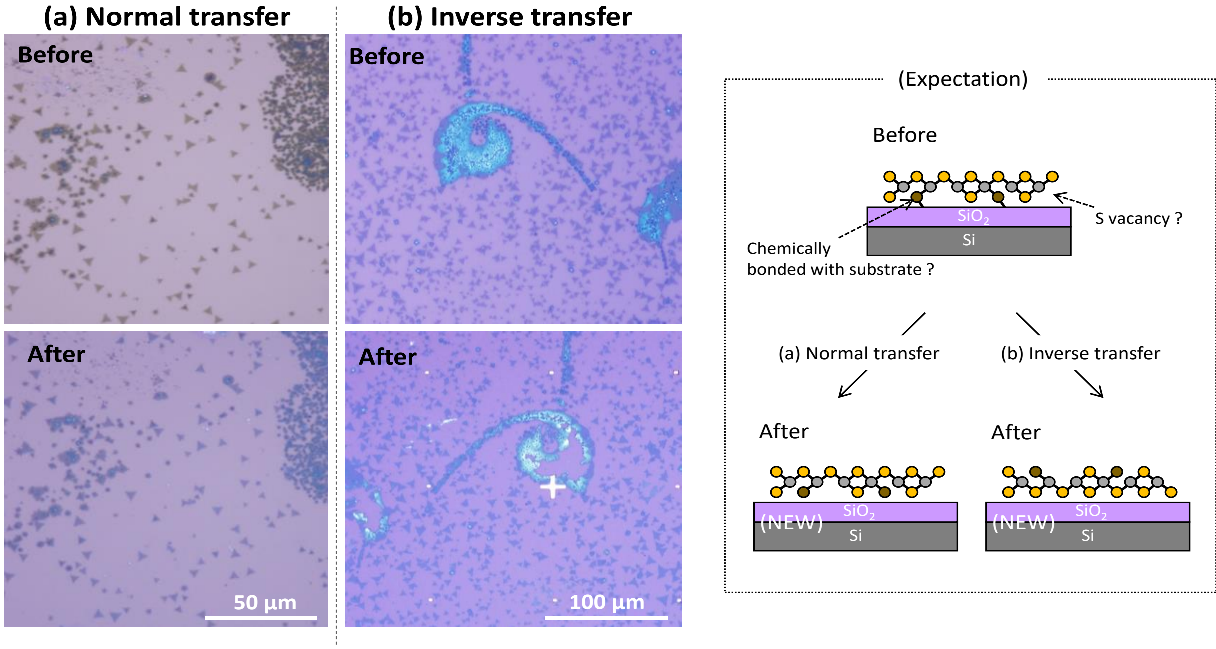

Figure S2: Optical images before and after the transfer of as-grown MoS_2 to new SiO_2/Si substrate. (a) normal transfer, and (b) inverse transfer. Expected schematic illustration for normal and inverse transfer of as-grown MoS_2 is also shown in the right figure. However, the transport properties for both normal and inverse transfers in **Fig. 6** in the main text suggest that the present crystallinity of CVD-MoS_2 is high enough to observe MIT and the difference in the crystallinity for top and bottom surfaces could be negligible.

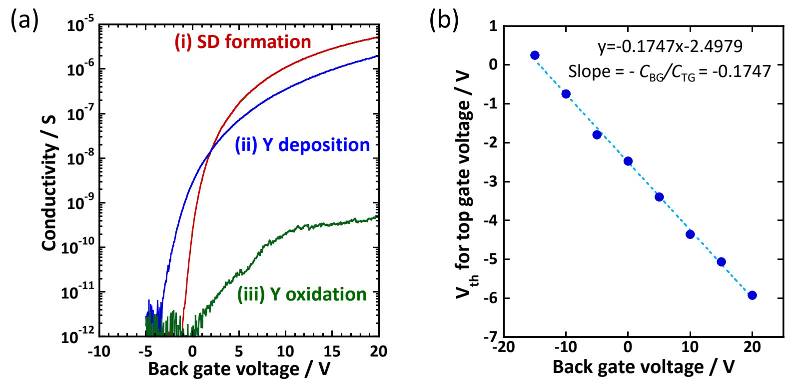

Table: Literature data for top-gate CVD-monolayer MoS_2 FET devices.

Year	Method	Material	Thickness nm	Mobility cm^2/Vs	Contact resistance	Ref.
2013	ALD	Al_2O_3	16	21.6	excluded	Nano lett. 2013, 13, 2640.
2014	ALD	HfO_2	30	7	excluded	Nature comm. 2014, 5, 3087.
2015	ALD	Al_2O_3	25	24	Included	Appl. Phys. Lett. 2015, 106, 062101.
2015	ALD	HfO_2	30	30	excluded	Nature 2015, 520, 656.
2015	ALD	HfO_2	30	63	excluded	Nano lett. 2015, 15, 5039.
2016	ALD	HfO_2	30	42.3	included	Appl. Phys. Lett. 2016, 203105.
2016	ALD	HfO_2	30	54	excluded	Adv. Mater. 2016, 28, 1818.
Present	ALD	Al_2O_3	31	32	excluded	

Figure S3: (a) Two-probe conductivity as a function of V_{TG} at V_{BG} = 0 V obtained during the each top gate formation process for the device with Ti/Au electrodes. It is clear that the conductivity was drastically reduced after the oxidation of the Y metal buffer layer at 200 °C for 10 min. (b) The trace of V_{th} for the V_{TG} sweep in **Fig. 5a** in the main text is plotted as a function of V_{BG}. The linear relation can be seen. Table shows the literature data for top-gated CVD-grown monolayer MoS_2 FET.

Fig. S5

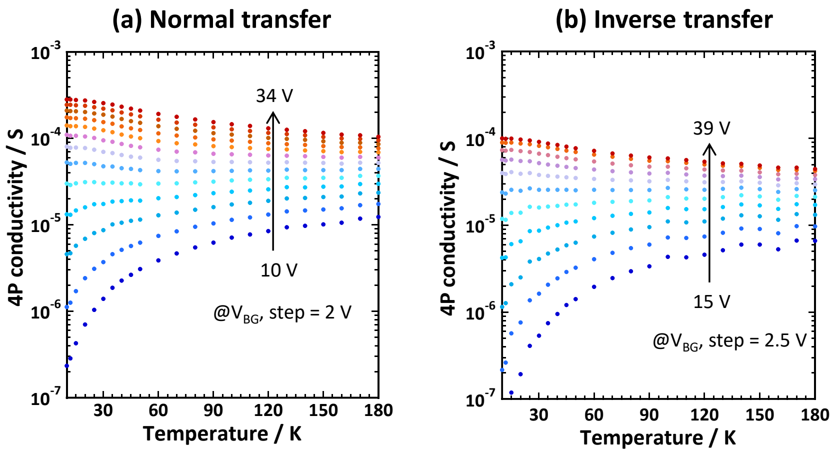

Table: Literature data for monolayer MoS_2 device showing MIT.

No.	Year	Sample	Substrate	Gate	Mobility cm^2/Vs	Ref.
a	2016	ME	HfO_2	BG	847	Adv. Mater. 2016, 28, 547.
b	2014	CVD	SiO_2	BG	500	Nano Lett. 2014, 14, 1909.
	Present	CVD	SiO_2	BG	470, 175	Normal & Inverse transfers
c	2015	ME	*h*-BN	BG	328	Nano Lett. 2015, 15, 3030.
	2014	ME	SiO_2	BG	320, 100	Nature comm. 2014, 5, 5290.
d	2013	ME	SiO_2	BG	250	Nano Lett., 2013, 13, 4212.
e	2014	ME	ion gate/SiO_2	TG	230	Sci. Rep. 2014, 4, 7293.
f	2013	ME	HfO_2	TG	184	Nature mater. 2013, 12, 815.
g	2103	ME	SiO_2	BG	120	Appl. Phys. Lett., 2013, 102, 173107.
h	2015	ME	*h*-BN	TG	90	Nature comm. 2015, 6, 6088.

Figure S4: Four probe conductivity as a function of temperatures for (a) normal transfer and (b) inverse transfer. Table shows the literature data for monolayer MoS_2 device showing MIT.