Supporting Information for

Direct CVD Growth of Graphene/MoS_2 Heterostructure with Interfacial Bonding for Two-Dimensional Electronics

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KEYWORDS

Graphene, Direct growth, Heterostructure, Transition metal dichalcogenides, Contact resistance

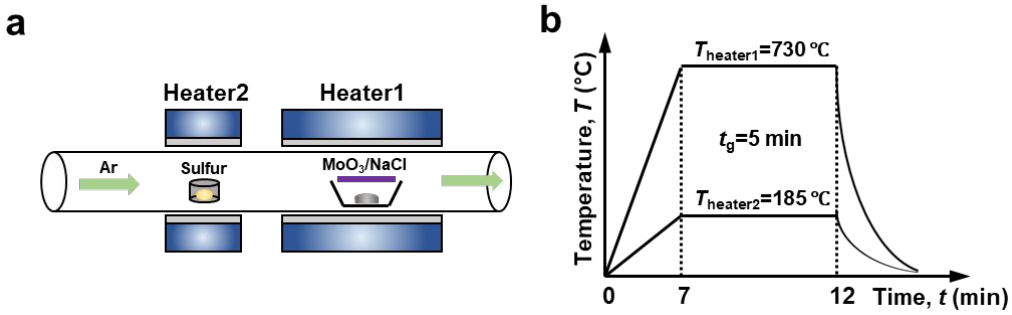

Figure S1. (a) Schematic diagram of the CVD experimental setup (b) and growth condition for MoS_2 synthesis.

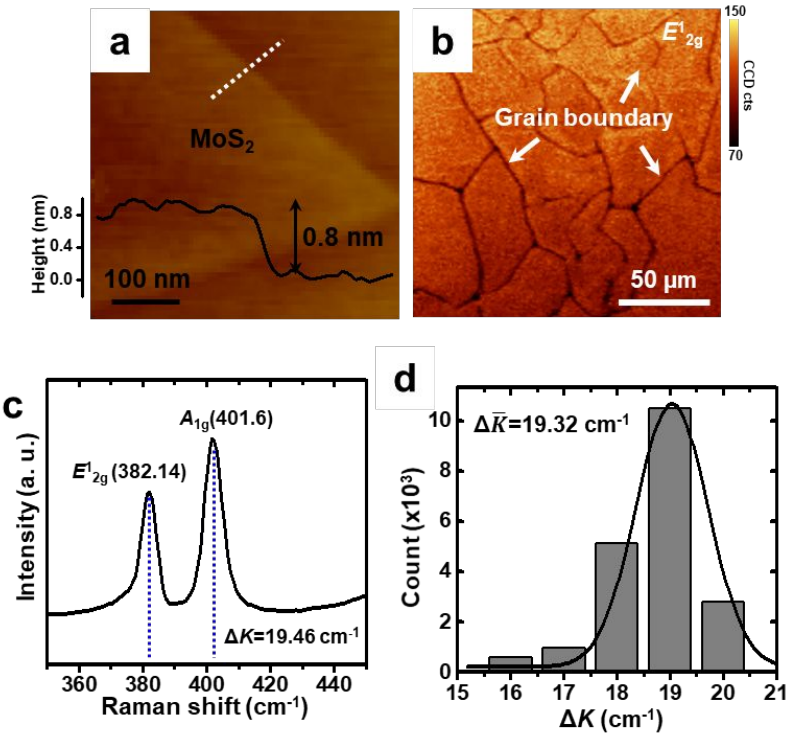

Figure S2. (a) AFM morphology of the MoS_2 monolayer for measuring thickness. (b) E^1_{2g} Raman mapping data and (c) single Raman spectrum of the synthesized MoS_2 monolayer on SiO_2/Si substrate. (d) The statistics of the Raman peak difference between E^1_{2g} and A_{1g} peak of the synthesized MoS_2 layer.

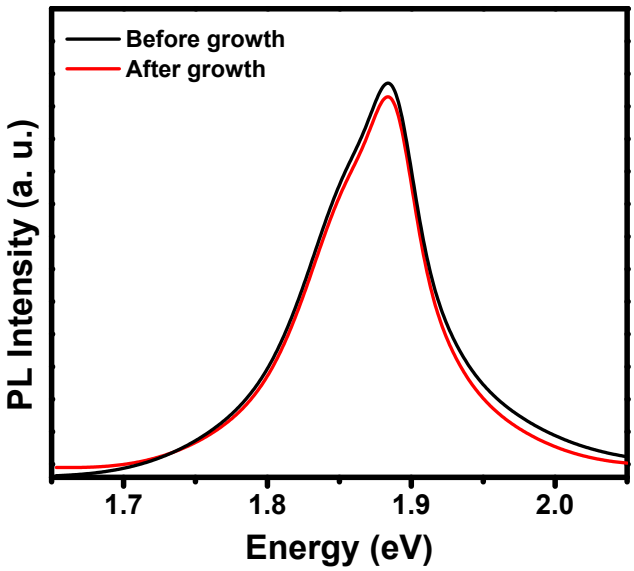

Figure S3. Photoluminescence spectra of the MoS_2 before (black) and after (red) graphene growth at the excitation wavelength of 514 nm.

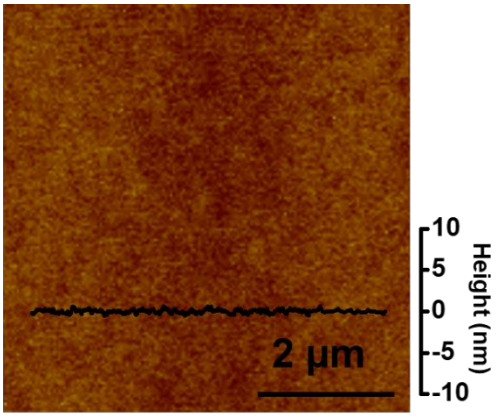

Figure S4. AFM morphology of synthesized graphene/MoS_2 heterostructure.

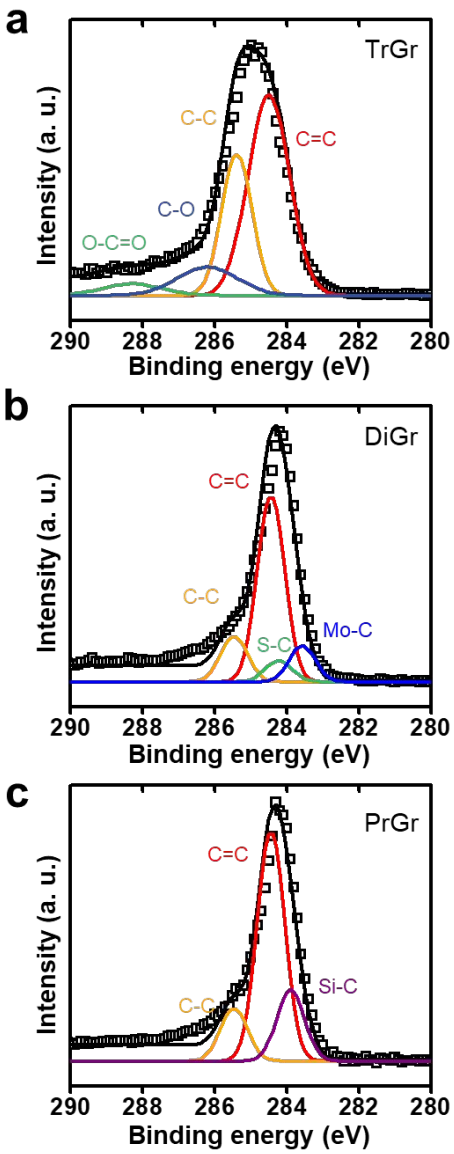

Figure S5. C1s XPS analysis of deconvoluted peaks of the interface between (a) MoS_2/TrGr, (b) MoS_2/DiGr, respectively. (c) C1s XPS analysis of the peak of the directly-grown graphene on SiO_2/Si substrate (PrGr).

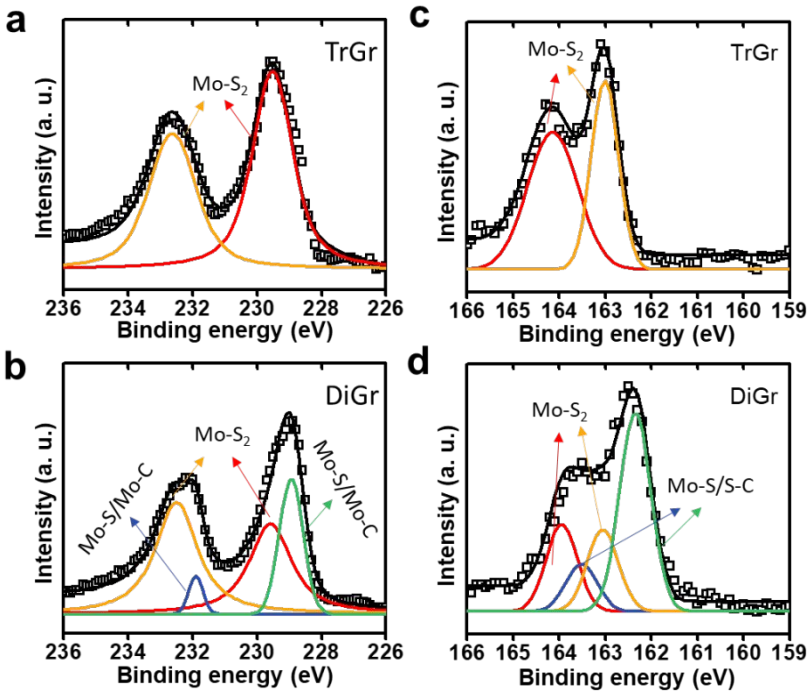

Figure S6. Mo3d XPS analysis of deconvoluted peaks of the interface between (a) MoS_2/TrGr and (b) MoS_2/DiGr. S2p XPS analysis of deconvoluted peaks of the interface between (c) MoS_2/TrGr and (d) MoS_2/DiGr.

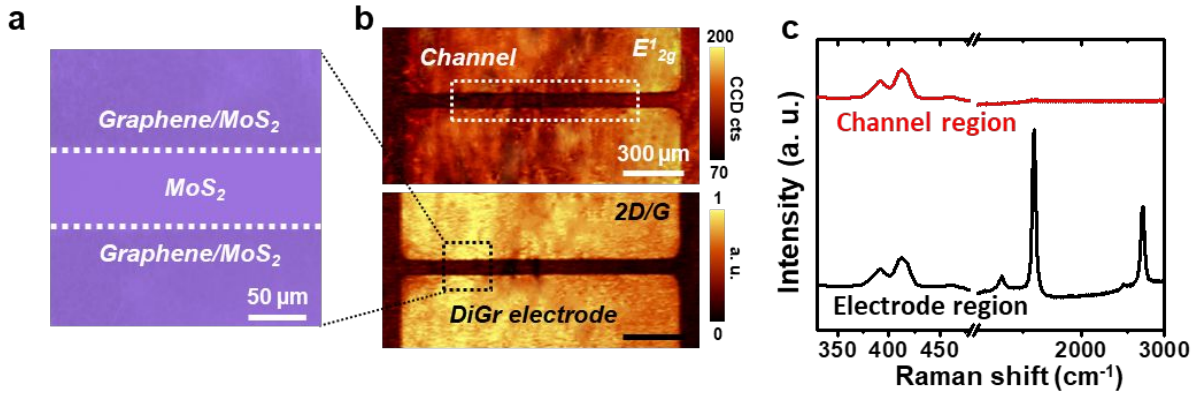

Figure S7. (a) Optical microscopy image of the channel region in the fabricated MoS_2-FETs. (b) (top) E^1_{2g} and (bottom) *2D*/*G* Raman mapping data of directly grown patterned graphene on MoS_2 monolayer. (c) Single Raman spectrum of the channel region (white dashed area) and electrode region.

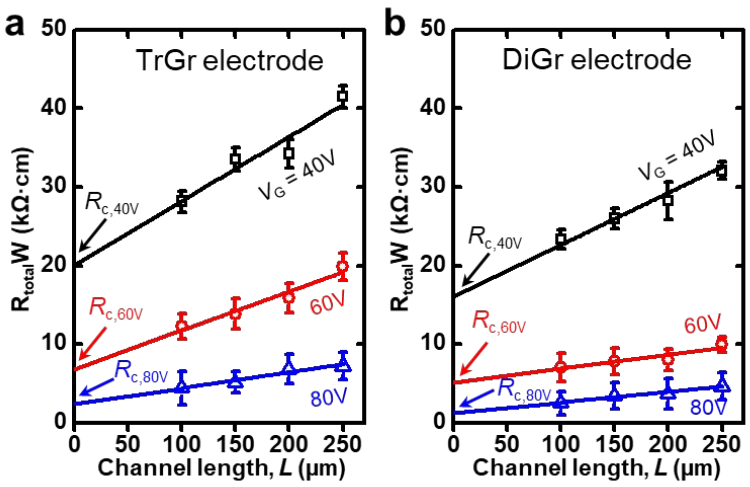

Figure S8. Channel width-normalized R_{total} obtained from the MoS_2 FETs prepared with (a) transferred graphene electrodes (TrGr) and (b) directly-grown graphene electrodes (DiGr) on SiO_2/Si substrate.

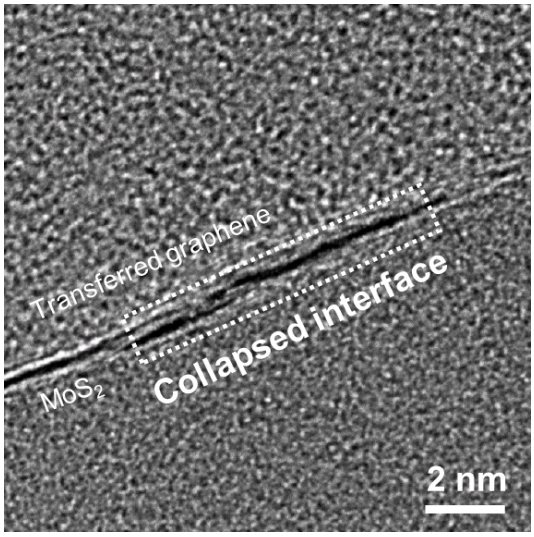

Figure S9. High resolution cross-sectional TEM image of the transferred graphene/MoS_2 monolayer interface on SiO_2/Si substrate.

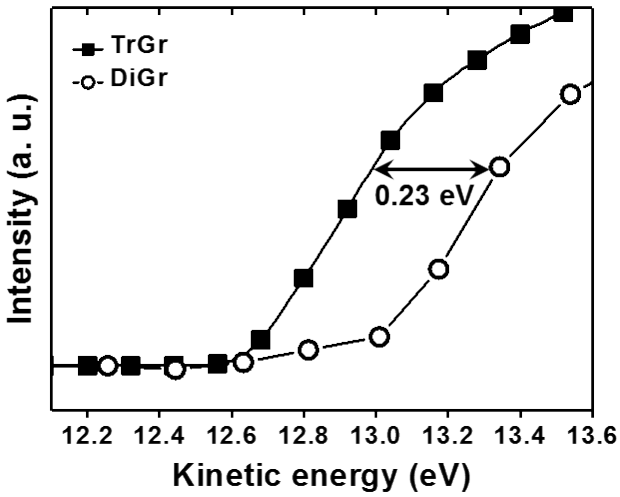

Figure S10. UPS curves obtained from TrGr (closed rectangular) and DiGr (open circle), in the secondary electron emission region.