Supporting Information

MoS_2-OH Bilayer Mediated Growth of Inch-Sized Monolayer MoS_2 on Arbitrary Substrates

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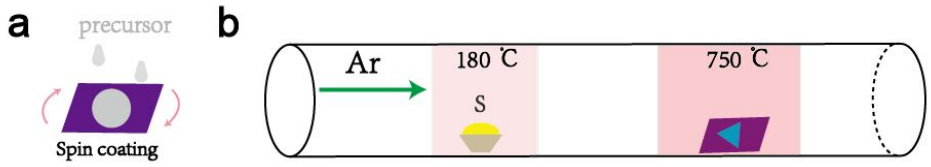

Figure S1. Schematic illustration of the MoS_2 growth process including (a) spin-coating precursor solution on the substrate and (b) Annealing process in the tube furnace.

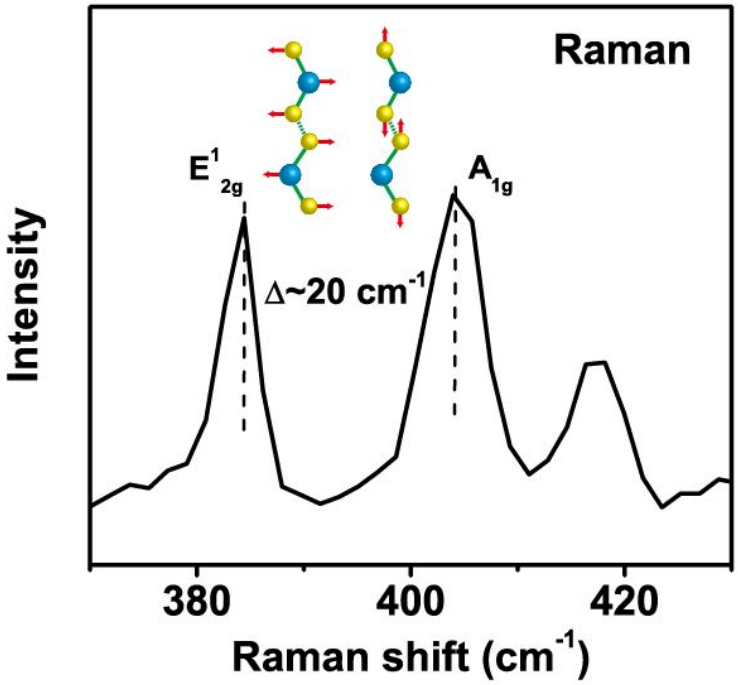

Figure S2. Raman spectra of the randomly selected position in the as-grown MoS_2 film. Raman modes of E^1_{2g} and A_{1g} are located at 384.3 cm^{-1} and 404.6 cm^{-1}, respectively, suggesting the monolayer nature. The peak at 418 cm^{-1} is resolved to the sapphire substrate.

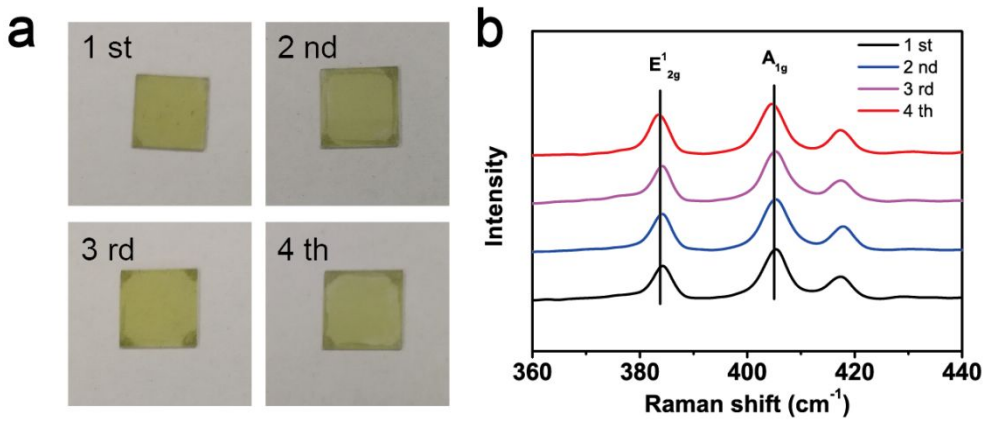

Figure S3. Photographs and Raman spectra of as-grown MoS_2 film on the sapphire substrate reused for four times. (a) Photographs show uniform films, (b) Raman spectra of four MoS_2 samples, E^1_{2g} and A_{1g} are located at ~384 cm^{-1} and ~404 cm^{-1}, respectively, corresponding to the monolayer.

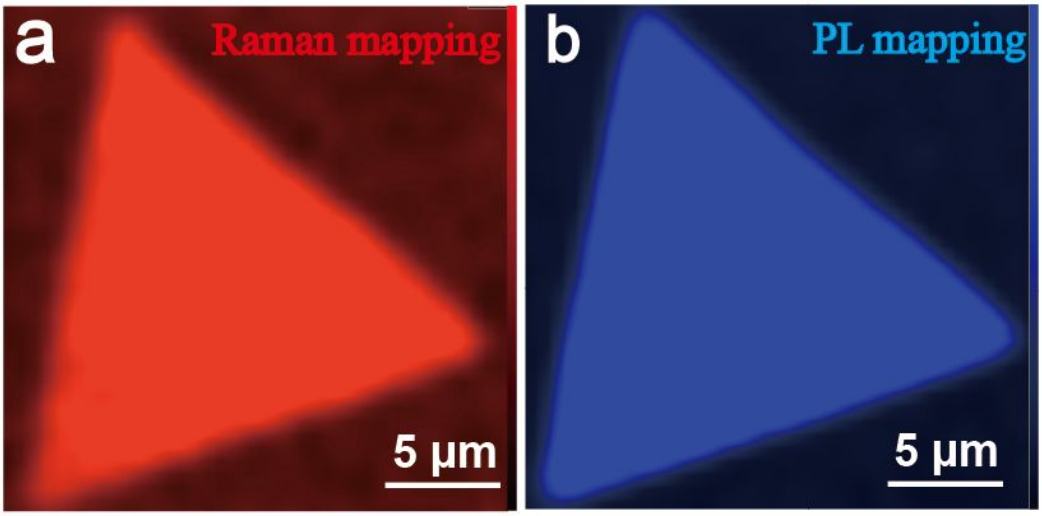

Figure S4. The monolayer MoS_2 keeps good uniformity in thickness. (a) Raman intensity map of A_{1g} peak, (b) PL map of the A-exciton.

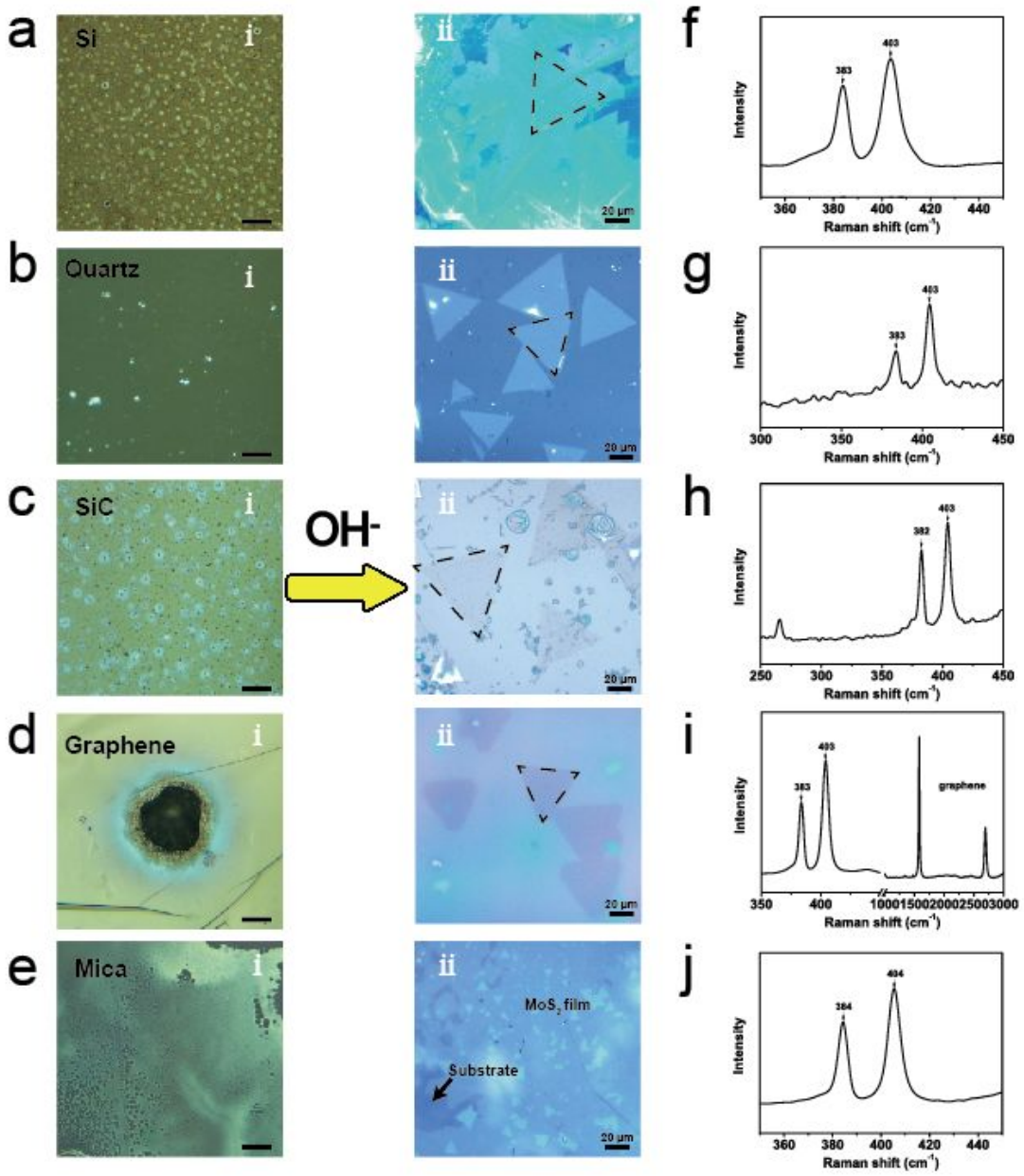

Figure S5. Substrate-independent growth of monolayer MoS_2. Optical microscopy (OM) images of MoS_2 grown on diverse substrates without (i) and with -OH (ii), respectively. (a) Si, (b) quartz, (c) SiC, (d) graphene, (e) mica. (f - j) Corresponding Raman spectra of as-grown MoS_2 with -OH on diverse substrates from ii, respectively.

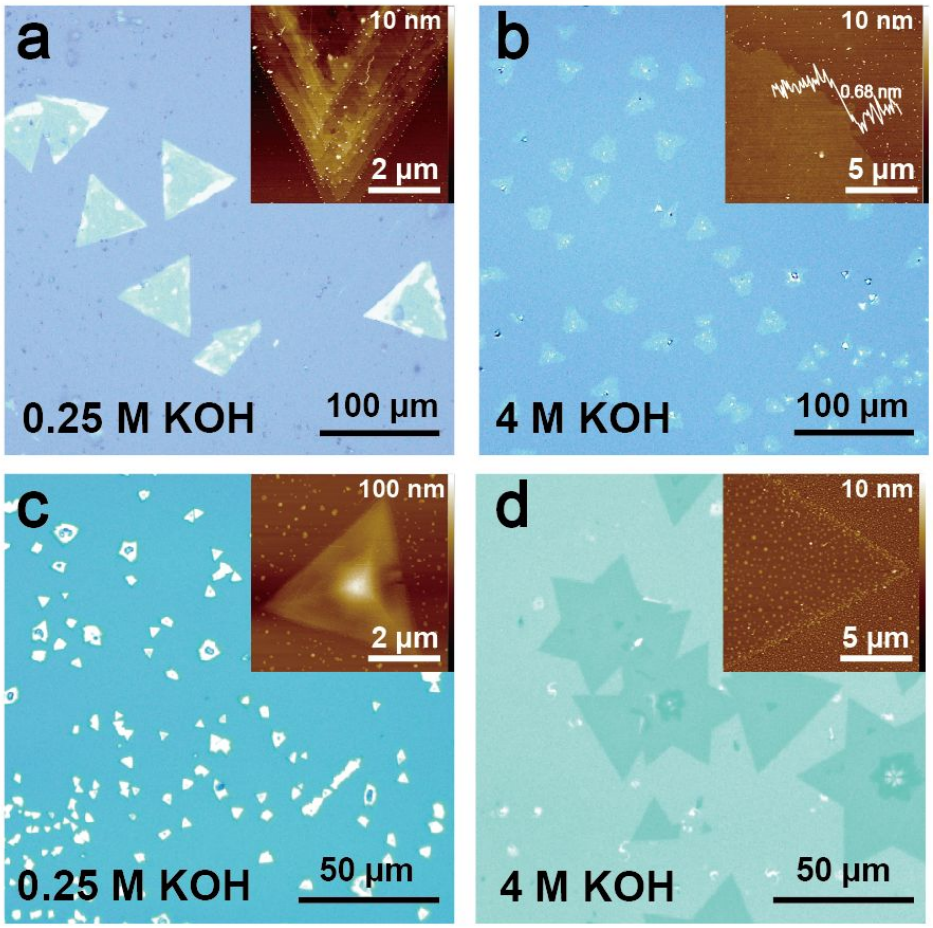

Figure S6. Insufficient and excess amount of -OH in the growth of monolayer MoS_2 (a, b) MoS_2 grown on sapphire with 0.25 and 4 M KOH, respectively. (b) MoS_2 grown on SiO_2 substrate with 0.25 and 4 M KOH, respectively.

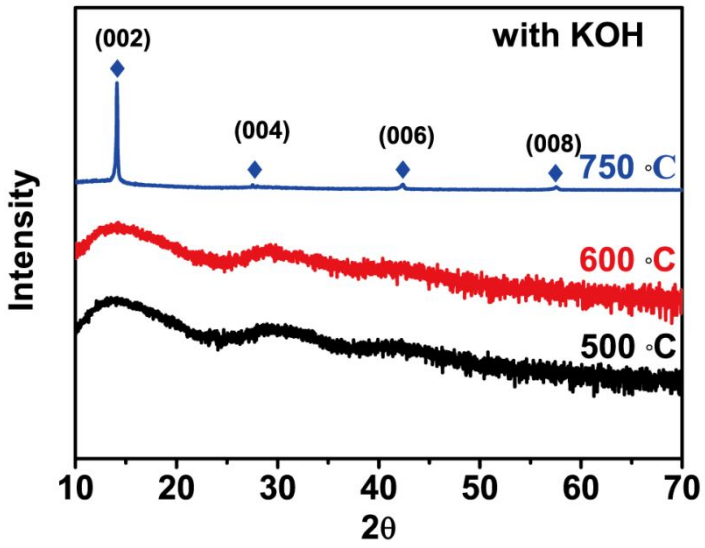

Figure S7. XRD patterns of the as-grown MoS_2 samples at different annealing temperature. MoS_2 samples have poor crystal quality at 500 and 600 ℃ but high-quality crystallinity at 750 ℃.

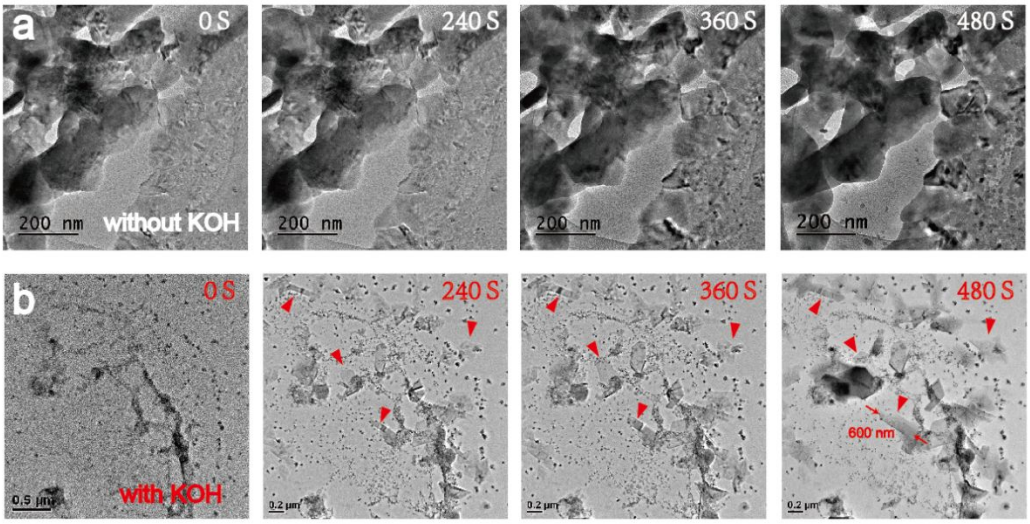

Figure S8. Long-time-resolved TEM images of the growth of MoS_2 at 750 ℃. As a comparison, (a) MoS_2 grown in precursor solution without KOH, (b) MoS_2 grown in 1 M KOH precursor solution. The length of flake increased from 0 to 600 nm.

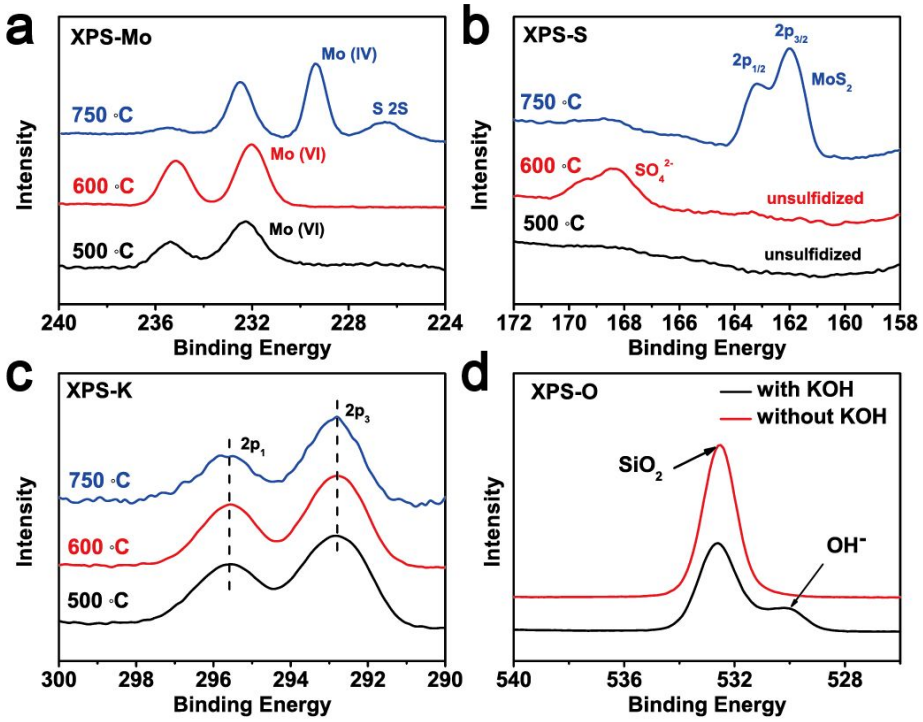

Figure S9. XPS spectra of as-grown MoS_2 samples at different temperature in annealing process. (a) Mo 3d, (b) S 2p, (c) K 2p, (d) O peak of the achieved MoS_2.

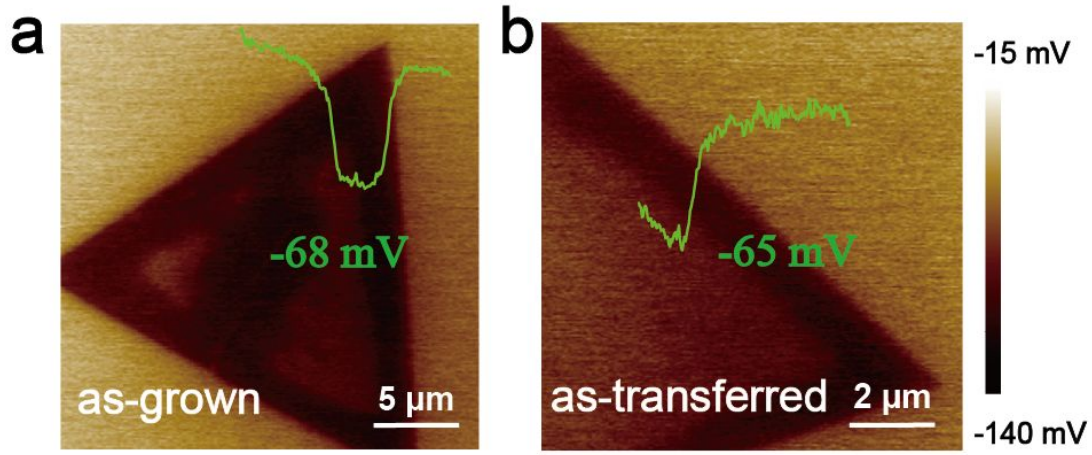

Figure S10. KPFM images of direct growth and as-transferred MoS_2 monolayers, respectively.

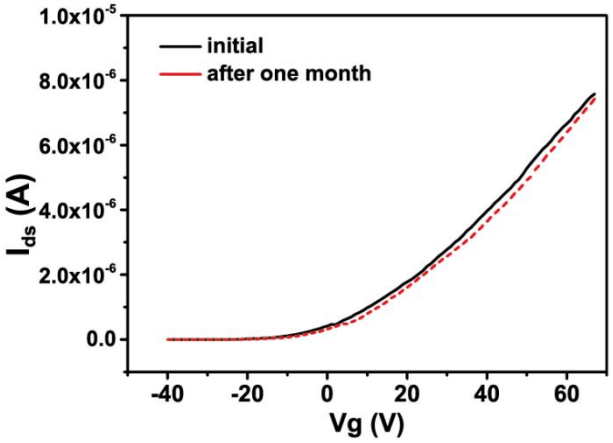

Figure S11. Transfer characteristics of the device before (black line) and after one month (red line) in air.

Supplementary Movie 1. The evolution of SAED patterns during the crystallization process.

Supplementary Movie 2. dynamical behavior of the increased flake at 750 ℃.