Is charge transfer doping possible at the interfaces of monolayer VSe_2 with MoO_3 and K?

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1. The work function of VSe_2 as a function of coverage.

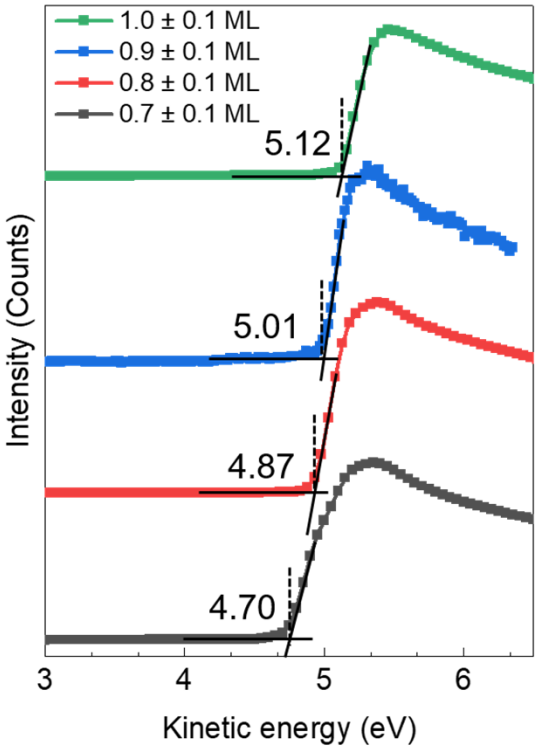

Figure S1. The work function of VSe_2/HOPG as a function of VSe_2 coverage. The work function increases from ~4.70 to ~5.10 eV with the increasing coverage from 0.7 ± 0.1 monolayer (ML) to 1.0 ± 0.1 ML.

2. The control experiment of MoO_3 deposition on monolayer $MoSe_2$:

The STM of monolayer $MoSe_2$ in Figure S2a shows the dense mirror twin grain boundaries (MTGBs). Deposition of 1 Å MoO_3 on $MoSe_2$ is shown in Figure S2b. The inset of Figure S2b is the zoom-in image of the red square, showing the MTGBs. Although MoO_3 tends to adsorb on $MoSe_2$ edges, no preferential adsorption of MoO_3 on MTBs was observed, demonstrating that the VSe_2 edges are more chemically reactive than $MoSe_2$ grain boundaries.

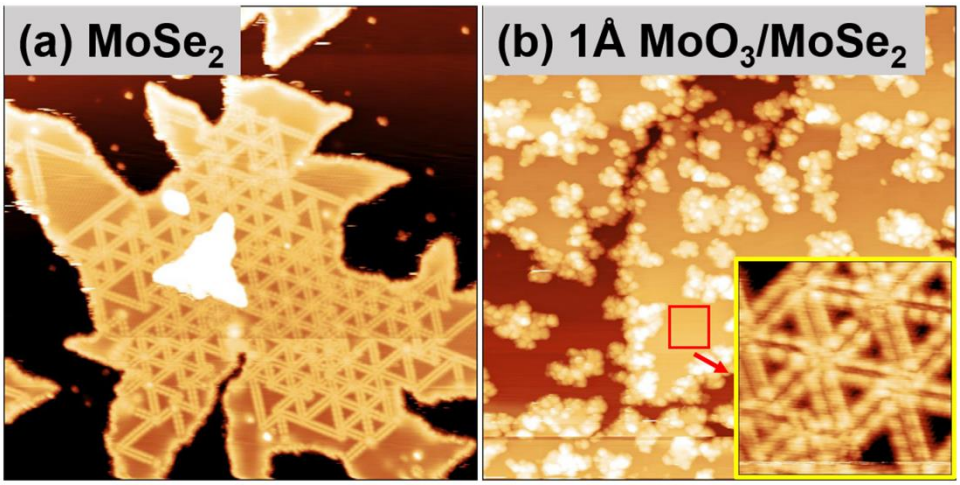

Figure S2. STM images of (a) $MoSe_2$ and (b) 1 Å MoO_3 on $MoSe_2$. (Scan size: 100 × 100 nm^2 for both (a) and (b) and 13 × 13 nm^2 for the inset of (b); Setpoints: a, 1.5 V, 10.0 pA; b, -2.8 V, 11.0 pA; Inset of (b), -0.7 V, 100.0 pA)

3. Oxygen-exposure experiment of monolayer VSe_2.

The oxygen-exposure experiment of monolayer VSe_2 indicates that the VSe_2 edges are locally and easily oxidized by O_2, verifying its high chemical activity.

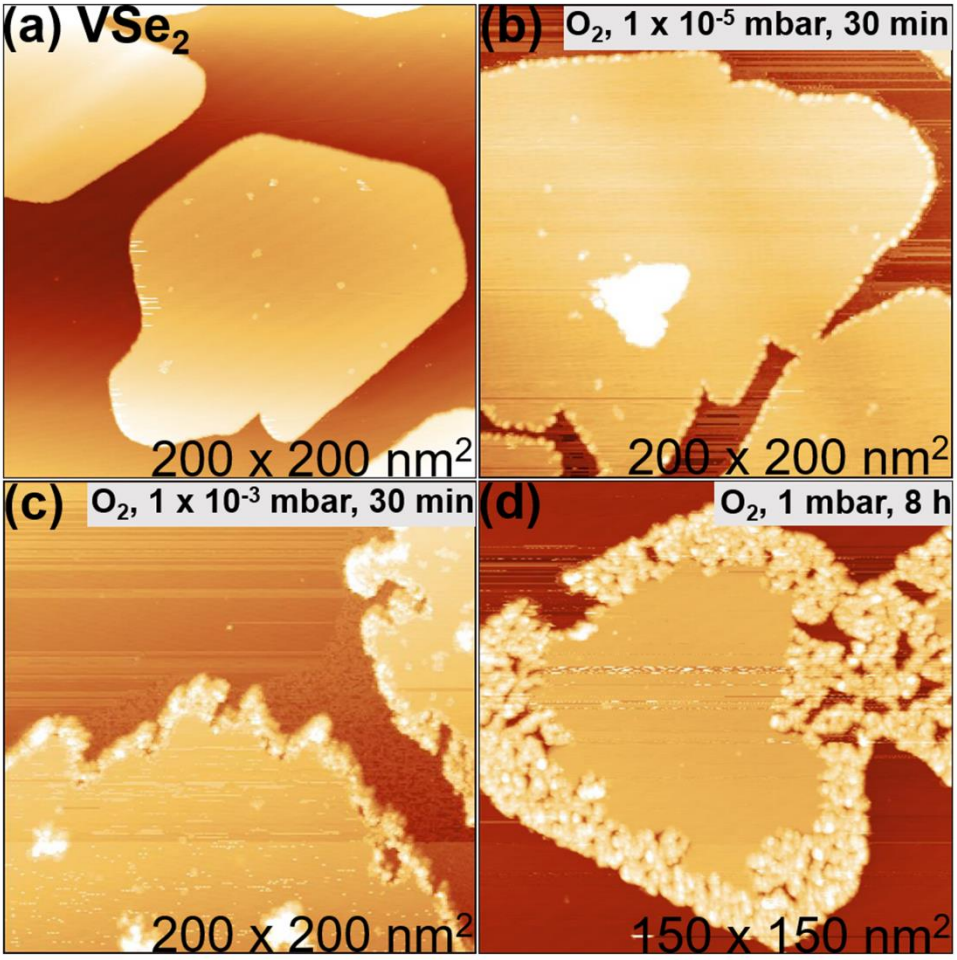

Figure S3. STM images of monolayer VSe_2 exposed to O_2. (a) Pristine VSe_2; (b) – (c) VSe_2 exposed to an O_2 partial pressure of ~ 1×10^{-5} mbar for 30 min, ~ 1×10^{-3} mbar for 30 min and ~ 1 mbar for 8 hours, respectively. (Setpoints: a, -1.4 V, 20.0 pA; b, -1.0 V, 24.0 pA; c, -1.4 V, 19.0 pA; d, -2.0 V, 21.0 pA)