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STM manipulation of intrinsic defects of 2H-$MoTe_2$

We investigated intrinsic defects of atomically thin 2H-$MoTe_2$ crystals using scanning tunneling microscopy (STM) and the first principle calculations. STM topography, in conjunction with the theoretical analysis, revealed identified adatom species as physically adsorbed Te atoms on the host $MoTe_2$ lattice. We were then able to manipulate such mobile Te adatoms into stabilized atomic positions by using bias pulses of the STM probing tip. We also confirmed through STS that in-gap state appears at the shallow level near the valence band maximum about Te adatoms. Our study provides a way to manipulate local properties of atomically thin transition-metal dichalcogenides with atomic precision.

References

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Figures

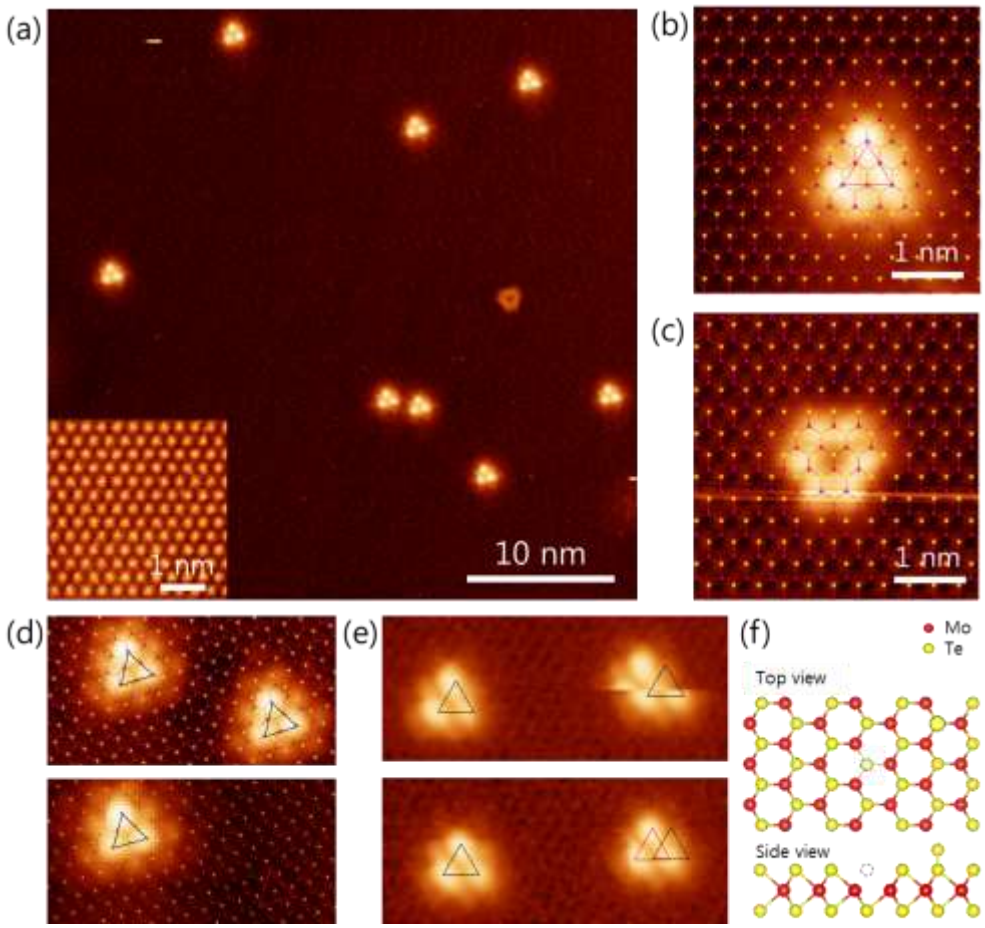

Figure 1: Intrinsic defects on 2H-$MoTe_2$ surface **(a)** Topographic image of large scale 2H-$MoTe_2$ (40 × 40 nm^2, V = -1.3 V, It = 200 pA), inset-pristine lattice (b)-(c) Magnified topography images **(b)** Te adatom (4 × 4 nm^2, V = -1.3 V, It = 200 pA), **(c)** V_{Te} (4 × 4 nm^2, V = -1.5 V, It = 200 pA) **(d)** Detachment and **(e)** relocation of Te adatom. **(f)** Schematic of Te single adatom and V_{Te} at 2H-$MoTe_2$.