Supporting Information

Electronic Structures and Transport Properties of MoS_2-NbS_2 Nanoribbon Lateral Heterostructure

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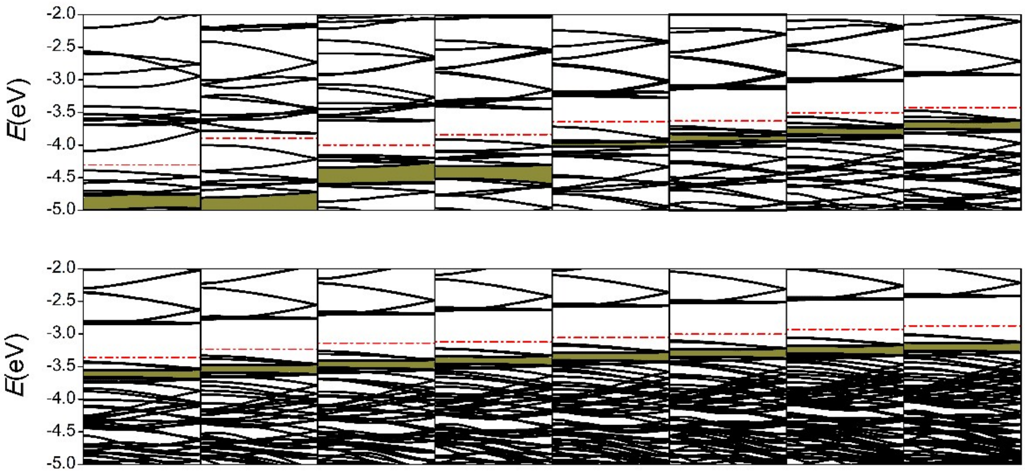

Fig.S1 Band structures of armchair MoS_2 nanoribbons（$AMoS_2NRs$）with the nanoribbon width(N_A) varying from 3 to 18. The red dash dot lines indicate the Fermi levels. Green regions indicate the forbidden bands below the Fermi level.

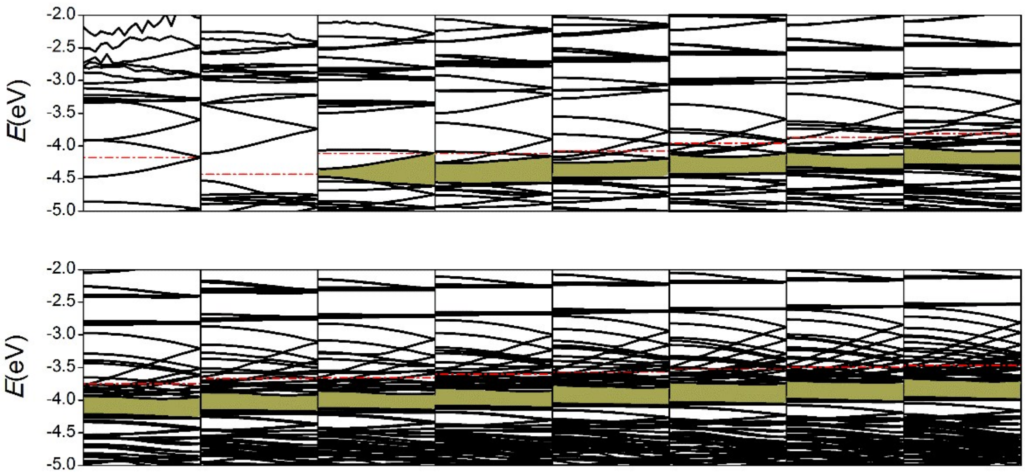

Fig.S2 Band structures of armchair NbS_2 nanoribbons（$ANbS_2NRs$）with the nanoribbon width(N_A) varying from 3 to 18. The red dash dot lines indicate the Fermi levels. Green regions indicate the forbidden bands below the Fermi level.

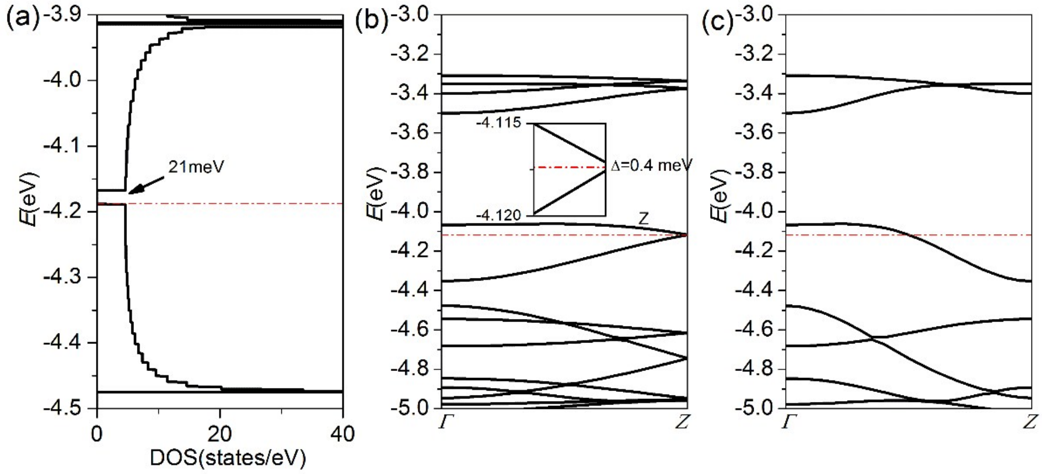

Fig.S3 (a) Density of states(DOS) of $ANbS_2NR$ with N_A=3, indicating a bandgap of 21 meV. (b)Band structure of $ANbS_2NR$ with N_A=5, calculated using a supercell of two primitive cell. (c)Band structure of $ANbS_2NR$ with N_A=5, calculated using a primitive cell.

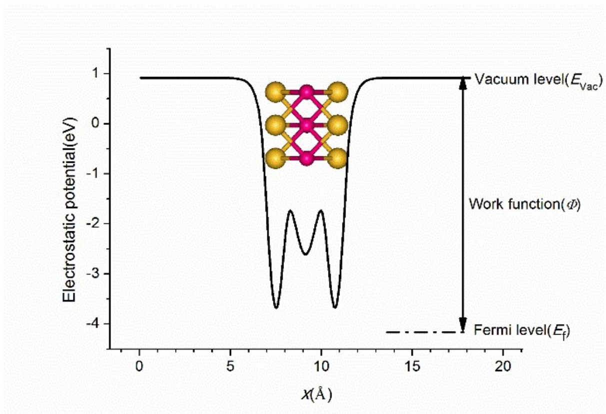

Fig.S4 Electrostatic potential in the direction perpendicular to the nanoribbon or monolayer surface (*x* direction). The value of electrostatic potential at the position far apart the surface is used as the vacuum level to calculate the work function. The example is an $ANbS_2NR$ of N_A=3.

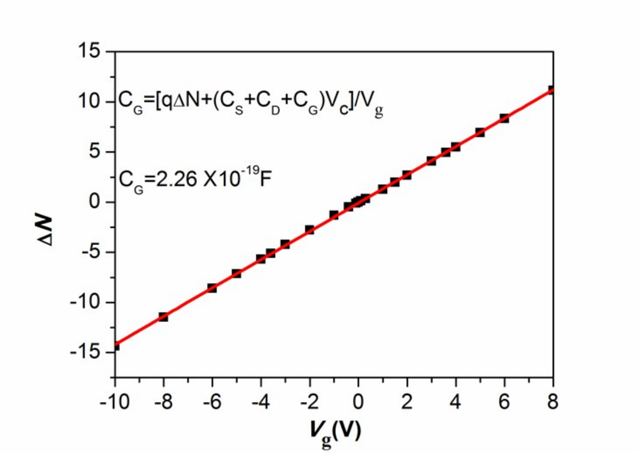

Fig.S5. The change(Δ*N*) in the number of electrons as a function of *V*g in the channel of AMoS$_2$NR -ANbS$_2$NR field effect transistor. The V_{bias} is set to be 0 V. Owning to the seamless contact, the electrostatic potential of channel (V_c) is also 0 V. With a capacitive circuit model[1], the gate oxide capacitance（C_G） is calculated to be 2.26X10^{-19}F, which is close to the result of 2.32X10^{-19}F from *εS*/*d,* where *S* is the size of channel and *d* is the thickness of dielectric region .

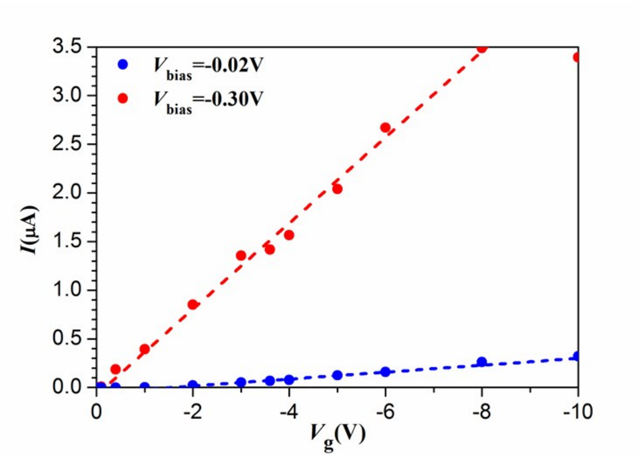

Fig.S6 Transfer characteristics of AMoS$_2$NR -ANbS$_2$NR field effect transistor with V_{bias}=-0.02 V and V_{bias}=-0.30 V. V_{bias}=-0.30 V is in the saturation region of transport characteristics. The saturation currents are proportional to V_g.

1. Datta, S., *Quantum Transport Atom to Transistor*. Cambridge University Press: United States of America by Cambridge University Press, New York, 2005.