

## **Supporting Information for**

### **Remarkable ferroelectricity–modulated electronic and magnetic properties in a $2H\text{-VS}_2/\text{BiAlO}_3(0001)$ hybrid system**

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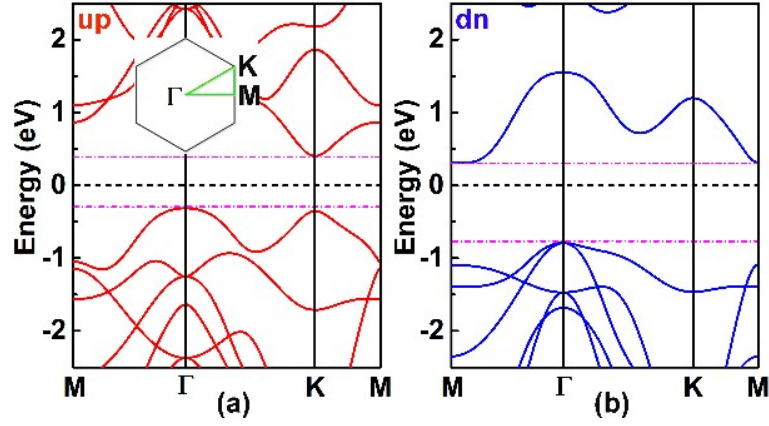


Fig. S1 Band structures in primitive-cell Brillouin zone of the pristine  $2H-VS_2$ . Here, (a) and (b) demonstrate the spin-up and spin-down channel, respectively, the energy scale is labeled with respect to the Fermi level, and the inset of Fig. S1a shows the First Brillouin zone of the hexagonal primitive-cell of the  $2H-VS_2$ .

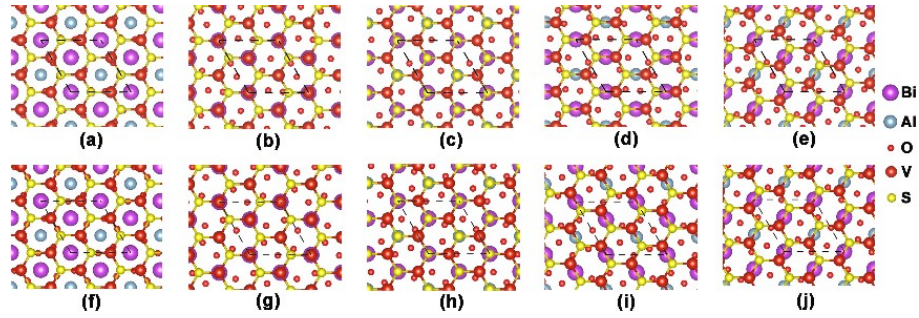


Fig. S2 Five typical interface configurations of the (a-e)  $2H-VS_2/BAO Z^+$  and (e-h)  $2H-VS_2/BAO Z^-$  systems (top views). For clarity, Only the surface termination, outer one  $-Al-O_3-Bi-$  trilayer ( $-Al-Bi-O_3-$  trilayers for  $BAO Z^-$  surface), and the  $2H-VS_2$  overlayer are plotted.

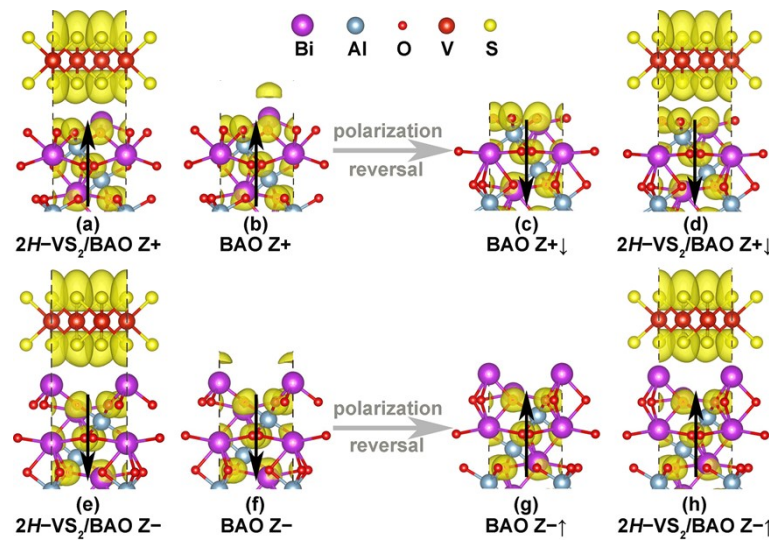


Fig. S3 ELF (side view) of the (a)  $2H-VS_2/BAO Z^+$ , (d)  $Z^+\downarrow$ , (e)  $Z^-$ , and (h)  $Z^-\uparrow$  systems as well as the clean (b)  $BAO Z^+$ , (c)  $Z^+\downarrow$ , (f)  $Z^-$ , and (g)  $Z^-\uparrow$  surfaces (the plotted isosurface is  $0.5 e/\text{\AA}^3$ ). Here, the black arrow denotes the ferroelectric polarization direction.