

## Supplementary information

### **Polarization-switching pathway determined electrical transport behaviors in rhombohedral BiFeO<sub>3</sub> thin film**

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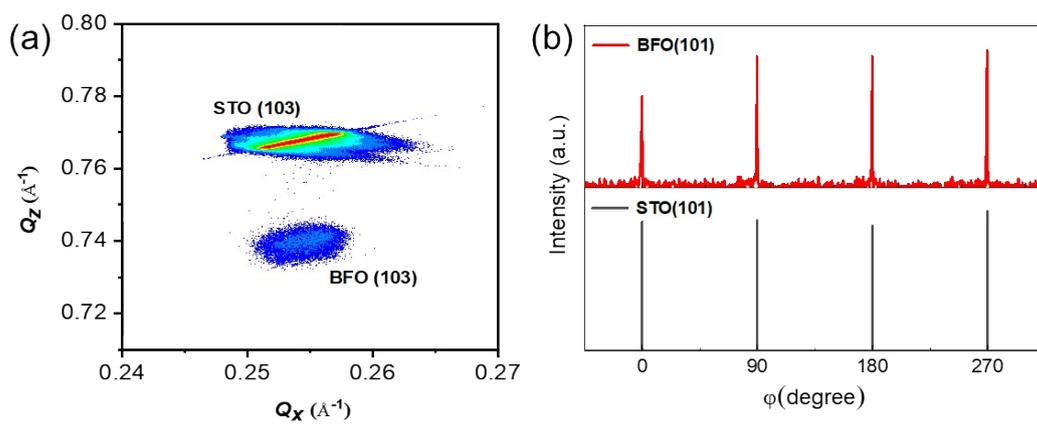


Fig. S1. RSM mapping (a) and a phi-scan (b) for (001)-oriented BFO/SRO/STO heterostructure, respectively.

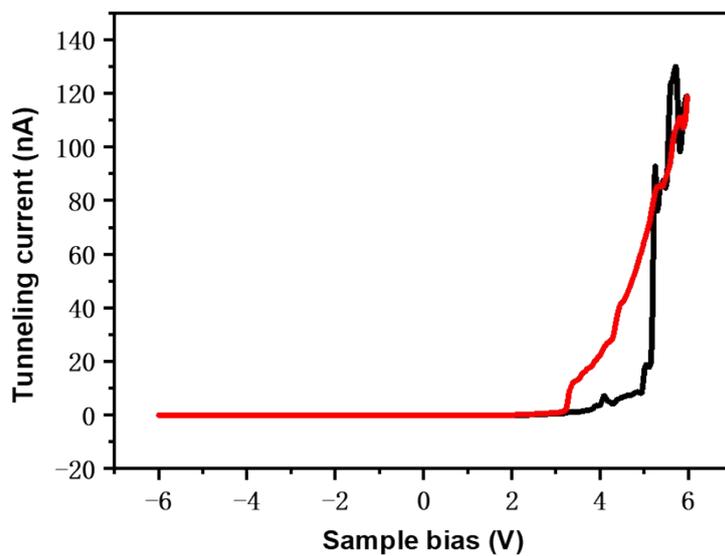


Fig. S2.  $I$ - $V$  curve with unidirectional current obtained in a ferroelectric capacitor with a point contact geometry.