

Supplementary Materials

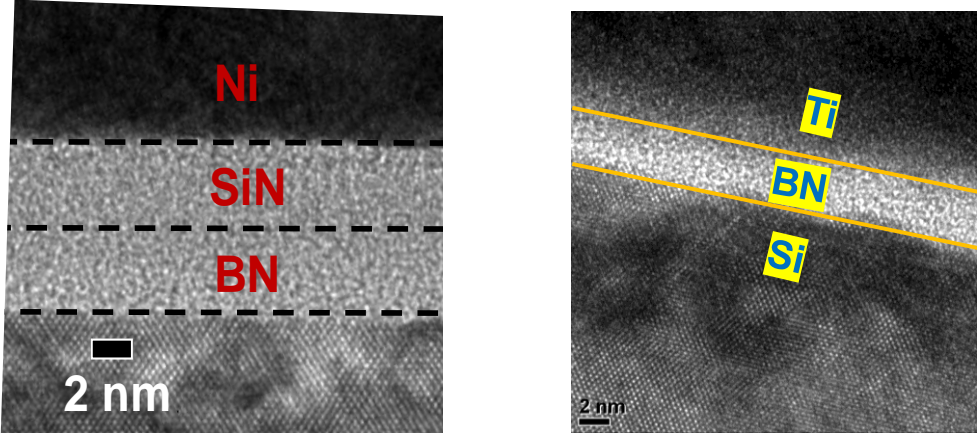


Figure S1. TEM image of (a) Ni/SiN/BN/Si device and (b) Ti/BN/Si device.

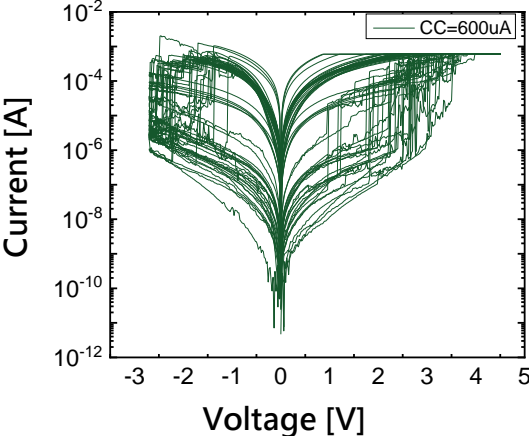
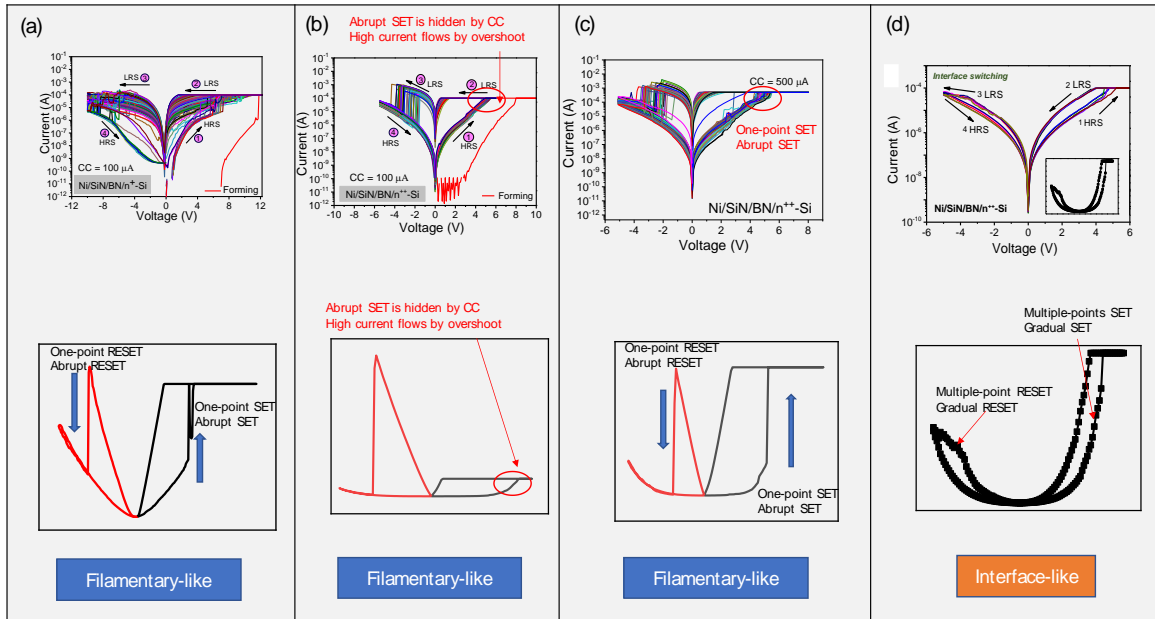


Figure S2. I-V curves of Ni/BN/Si device.



**Figure S3.** Classification of I–V curves (top: log scale and bottom: linear scale) in Ni/SiN/BN/n<sup>+</sup>-Si and Ni/SiN/BN/n<sup>++</sup>-Si devices: **(a)** Filamentary switching in Ni/SiN/BN/n<sup>+</sup>-Si showing abrupt set and reset with compliance current (CC) of 100  $\mu$ A. **(b)** Filamentary switching in Ni/SiN/BN/n<sup>++</sup>-Si with compliance current (CC) of 100  $\mu$ A. Abrupt set is not clear due to the high current is hidden by CC limitation. The high reset current indicates that high current overshoot occurs during the set operation of 100  $\mu$ A. **(c)** Filamentary switching in Ni/SiN/BN/n<sup>++</sup>-Si clearly showing abrupt set and reset with CC of 500  $\mu$ A. The high CC does not cover the abruptly increasing current. **(d)** Interface switching in Ni/SiN/BN/n<sup>++</sup>-Si with compliance current (CC) of 100  $\mu$ A. Gradual set and reset operation are clearly observed in linear scale.