Introduction of defects in hexagonal boron nitride for vacancy-based 2D memristors

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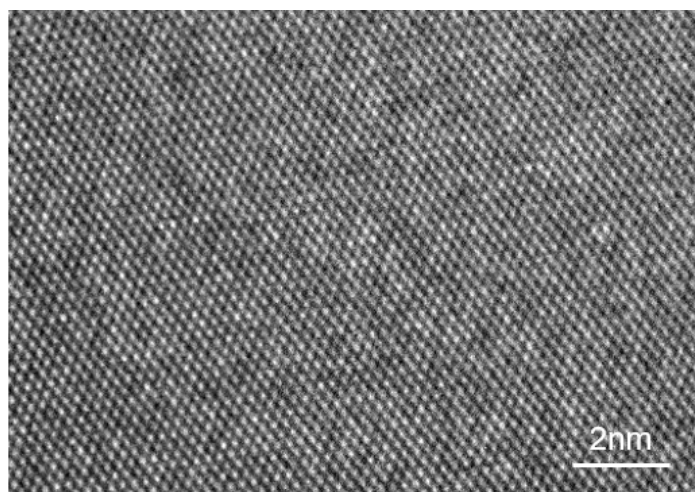*E-mail: wenjing.jie@sicnu.edu.cn, yudazhao@zju.edu.cn

Fig. S1. High-resolution transmission electron microscope (HRTEM) image of the high-quality h-BN.
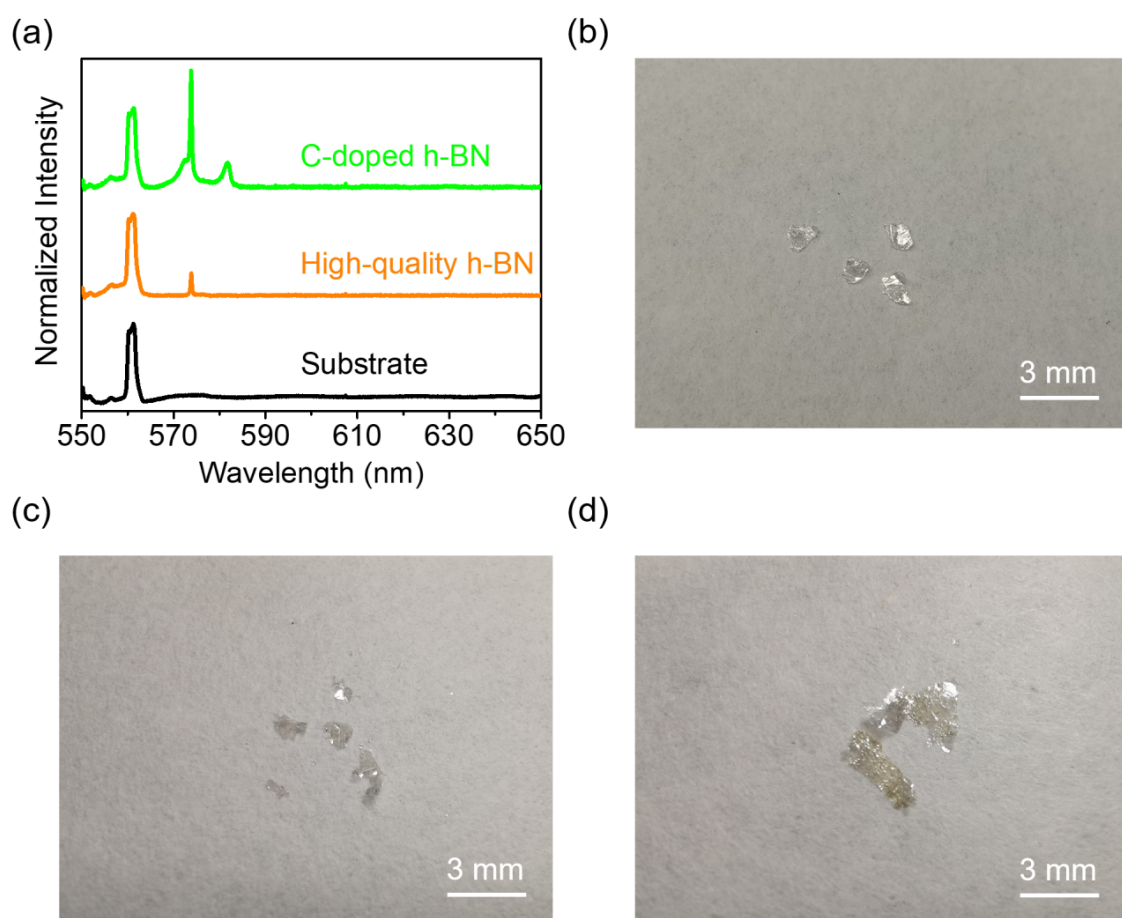
Fig. S2. (a) Photoluminescence (PL) characterization of carbon doped h-BN (C-h-BN) flakes, high-quality h-BN flakes and substrates. A single photon emission peak at 582 nm can be observed in the PL spectrum. Optical images of (b) high-quality h-BN crystals, (c) C-h-BN crystals, and (d) heavily C-doped h-BN crystals.
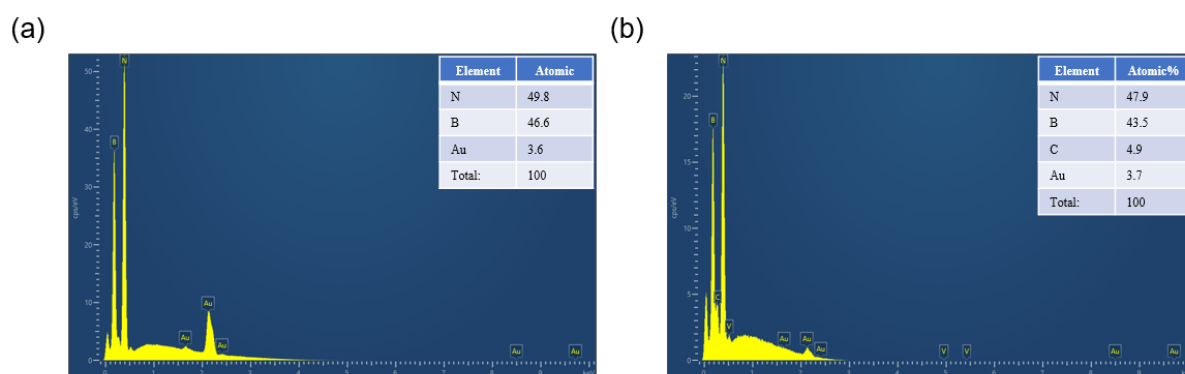
(a)

Element	Atomic
N	49.8
B	46.6
Au	3.6
Total:	100

(b)

Element	Atomic%
N	47.9
B	43.5
C	4.9
Au	3.7
Total:	100

Fig. S3. Energy-dispersive X-ray spectroscopy (EDS) analysis of the high-quality (a) and carbon-doped (b) h-BN nanosheets. The ratio of B and N atoms is 0.94: 1 and 0.91: 1, respectively.
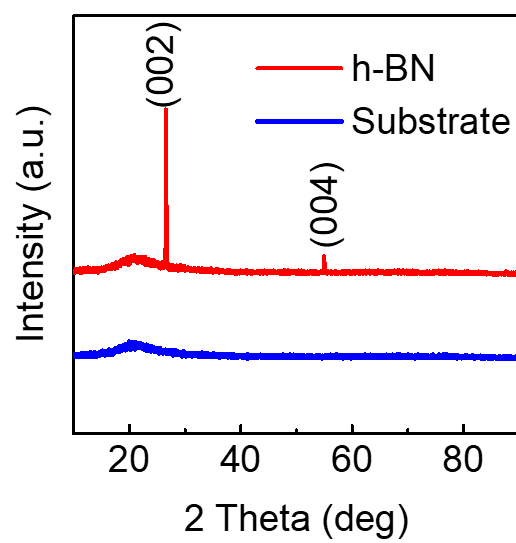
Fig. S4. X-ray diffraction (XRD) pattern of bulk C-h-BN crystal and glass substrate.
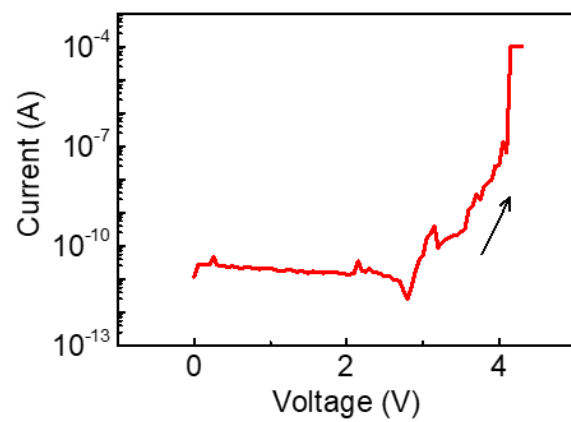
Fig. S5. Electroforming process of Au/C-h-BN/Au memristor. The current increased rapidly at a voltage of 4.2 V.
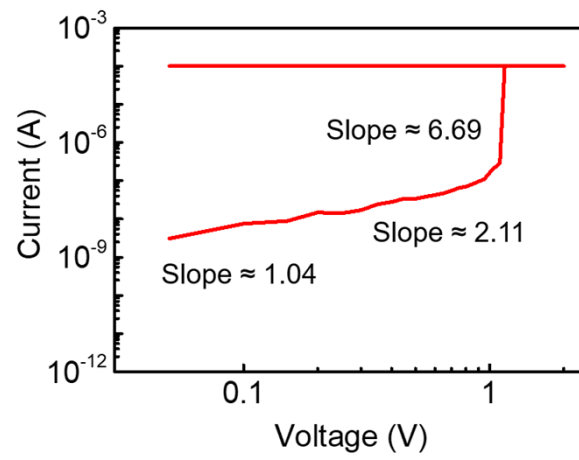
Fig. S6. The positive part of the I–V curve in Fig. 2c using double-logarithmic coordinates. The linear fitting of the curve displays three regions according to $I \sim V^a$: $a \approx 1.04$, $a \approx 2.11$ and $a \approx 6.69$.
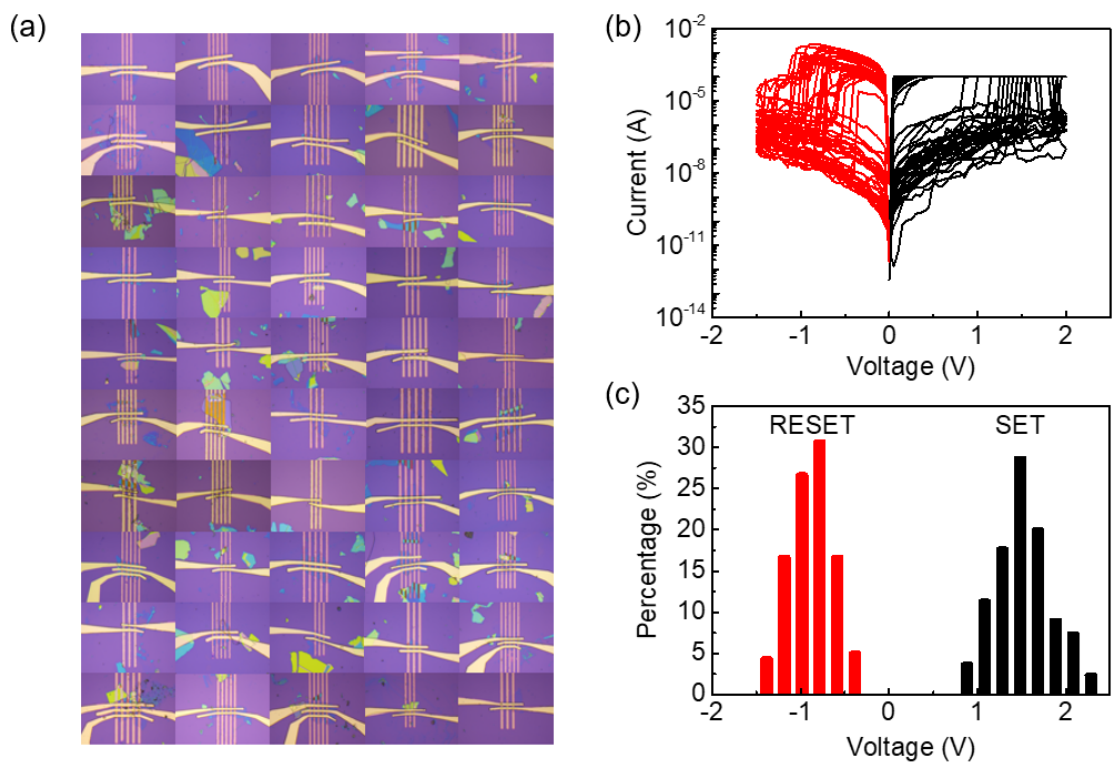
Fig. S7. (a) Optical images of 50 Au/h-BN/Au RRAM crossbar arrays. (b) I-V curves of 30 representative device. (c) Statistical distribution of SET and RESET voltages extracted from I-V curves of 300 Au/h-BN/Au RRAM devices in 50 crossbar arrays.
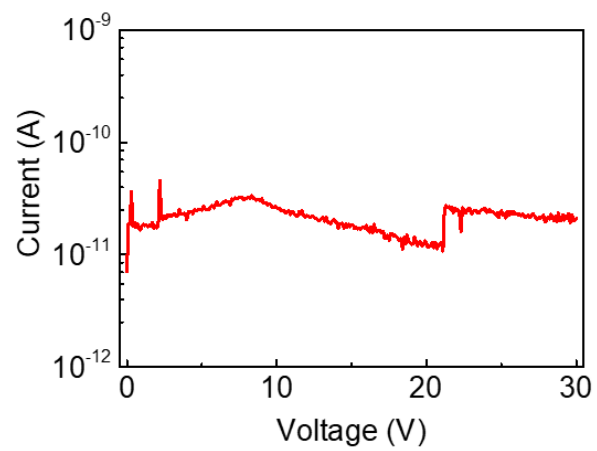
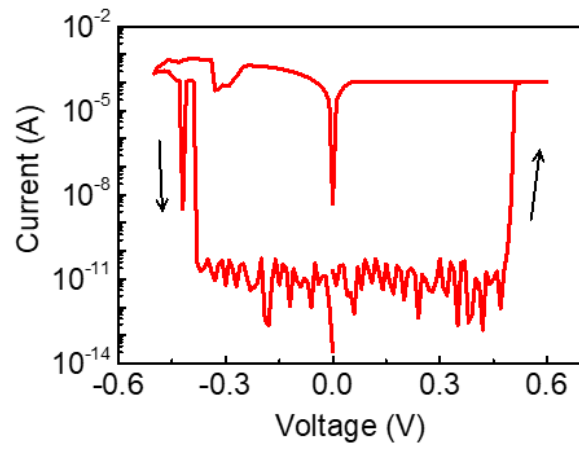**Fig. S8**. I-V curve of Au/h-BN/Au device with high-quality h-BN as the resistance switching layer.
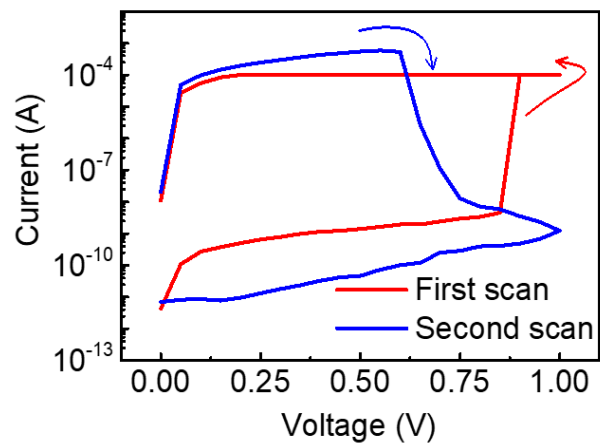
Fig. S9. I-V curve of Ag/C-h-BN/Au memristor device.

Fig. S10. Non-volatile unipolar I–V curves of the C-h-BN memristor devices.
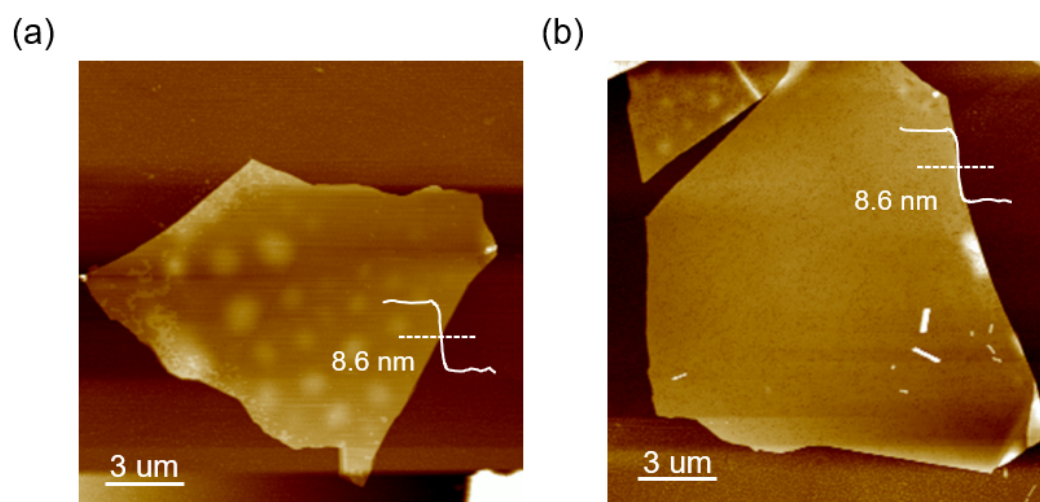
Fig. S11. The tapping mode AFM images of the mechanically exfoliated (a) C-h-BN and (b) high-quality h-BN flakes, respectively. Inset shows the height profile of the flake.