

Electronic Supplementary Materials (ESI) for PCCP

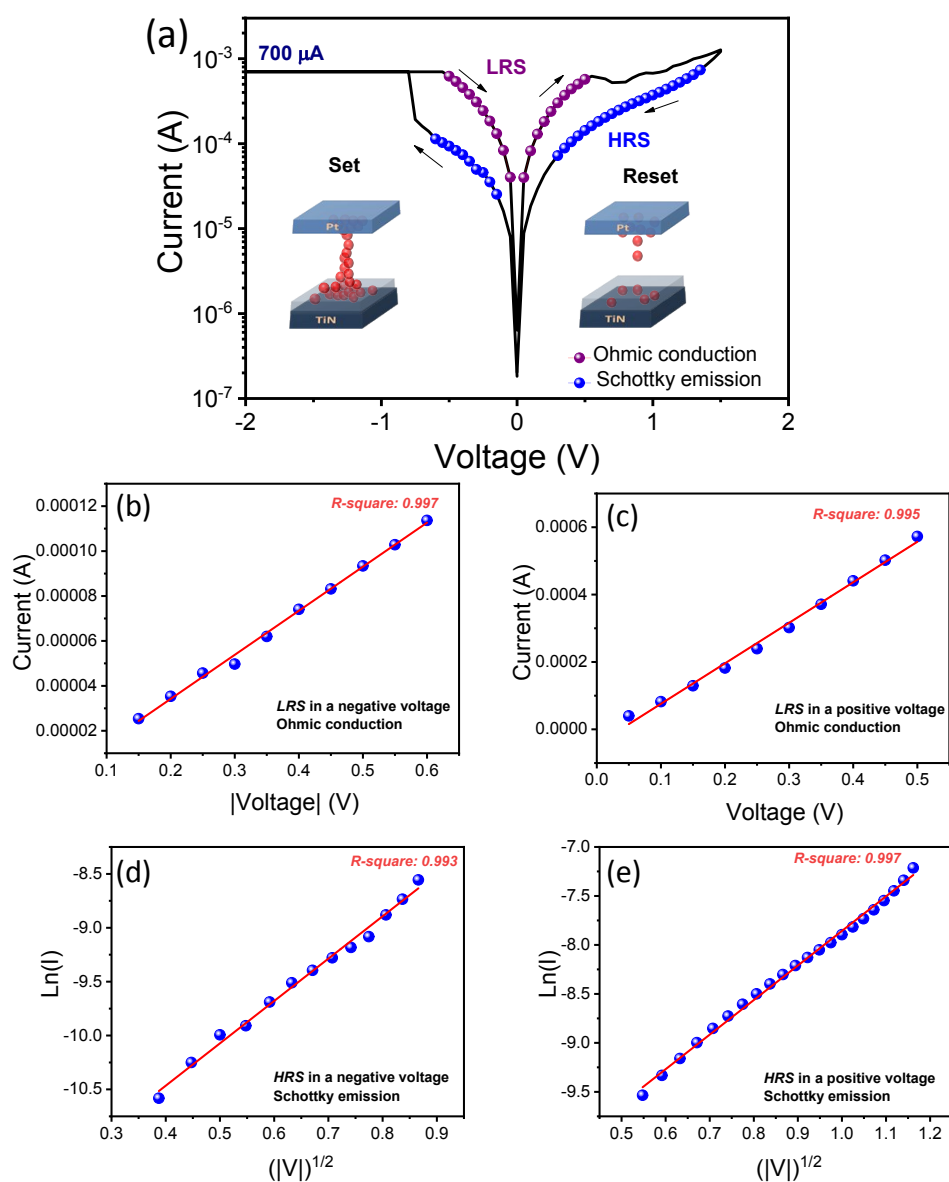


Fig. S1 Fitting results of Pt/HfAlO_x/TiN device in type 1 (a): Ohmic conduction in (b) a negative region and (c) a positive region for LRS. Ln(I) versus V^{1/2} fitting for Schottky emission in (d) a negative region and (e) a positive region for HRS.

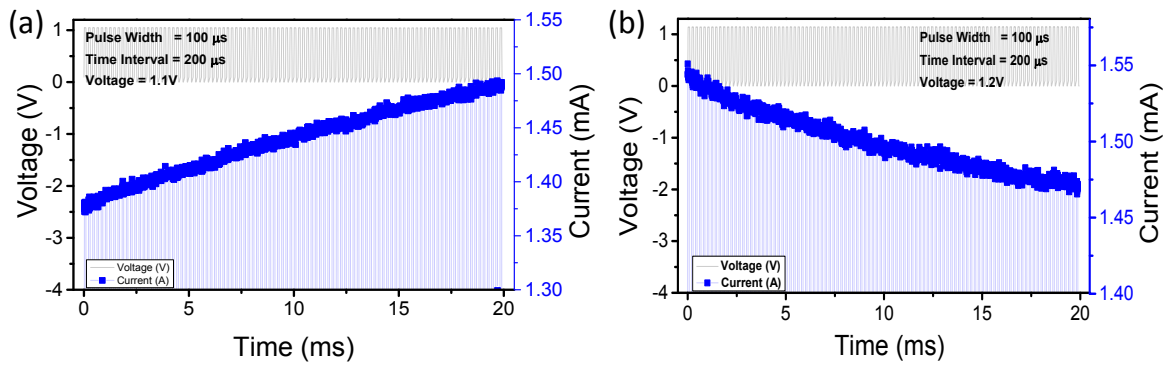


Fig. S2 Gradual set and reset by pulse train in CRS mode: (a) set (1.1 V) and (b) reset (1.2 V) by voltage amplitude.

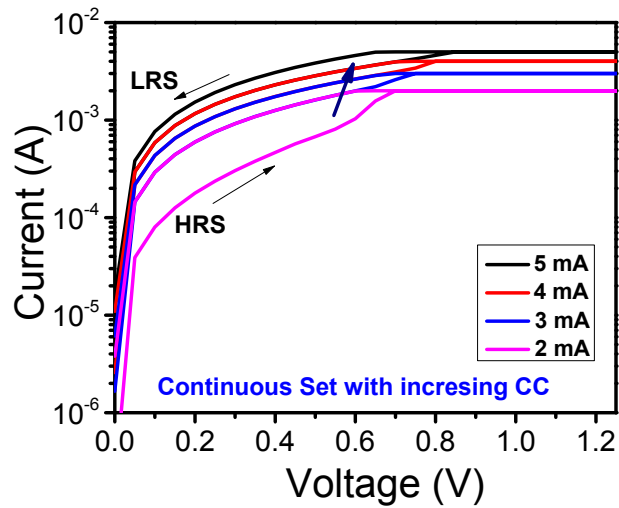


Fig. S3 Gradual set and reset by pulse train in CRS mode: (a) set (1.1 V) and (b) reset (1.2 V) by voltage amplitude.

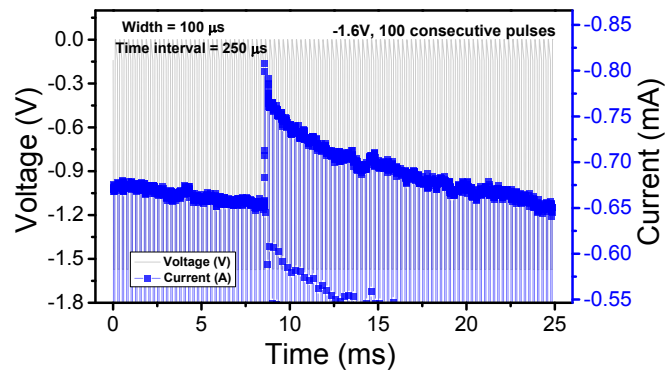


Fig. S4 Short-term effect (current decay after abrupt jump) by pulse train.

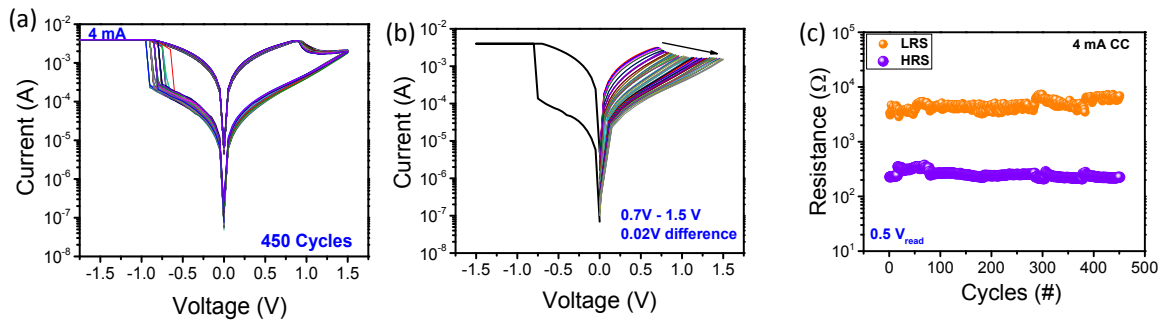


Fig. S5 BRS operation at CC of 4 mA: (a) Typical I-V curves, (b) MLC by reset stop voltage control, (c) endurance up to 450 cycles.

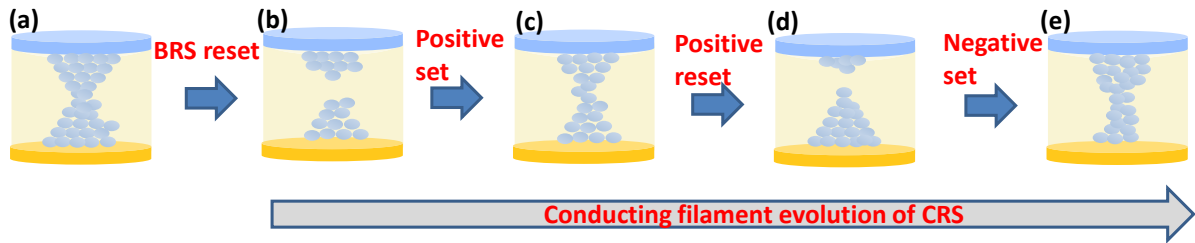


Fig. S6 Schematic of possible filament evolution for transition from BRS to CRS: (a) LRS and (b) HRS after reset in BRS mode. (c) Set and (d) subsequent reset in a positive bias in CRS mode. (e) Set in a negative bias in CRS mode.