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Supplementary Materials for

Broadband Photoelectric Tunable Quantum Dot Resistive Random Access Memory

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1. Synthesis of PbS quantum dots

Chemicals： Lead oxide (PbO, 99.99% pure from Aladdin), octadecene (ODE, 90% pure from Acros organics), oleic acid (OA,80−90% pure from Aladdin), bis(trimethylsilyl) sulfide ((TMS)2S 95% pure from Acros organics), methanol, toluene, acetone, and n-hexane were used during the synthesis process.

Methods：Firstly, 1.34 g PbO, 3.8 mL OA and 37.5 mL ODE were taken in 100 mL 3-necked round bottom flask, and the mixture was stirred under Nitrogen environment for 1h at 90 °C to remove oxygen and moisture. Secondly, heated at 120 °C for about 10 min to get clear solution. Third, increase the temperature to 150 °C and 18 mL of bis(trimethylsilyl) sulfide solution (630 μL (TMS)2S in 20 mL ODE) was quickly injected to the reaction solution. After 5 s, the reaction solution was cooled in cold water. Forth, the reactant was washed three times with methanol, n-hexane, and acetone. Lastly, redissolve and store the PbS quantum dots in toluene solution.

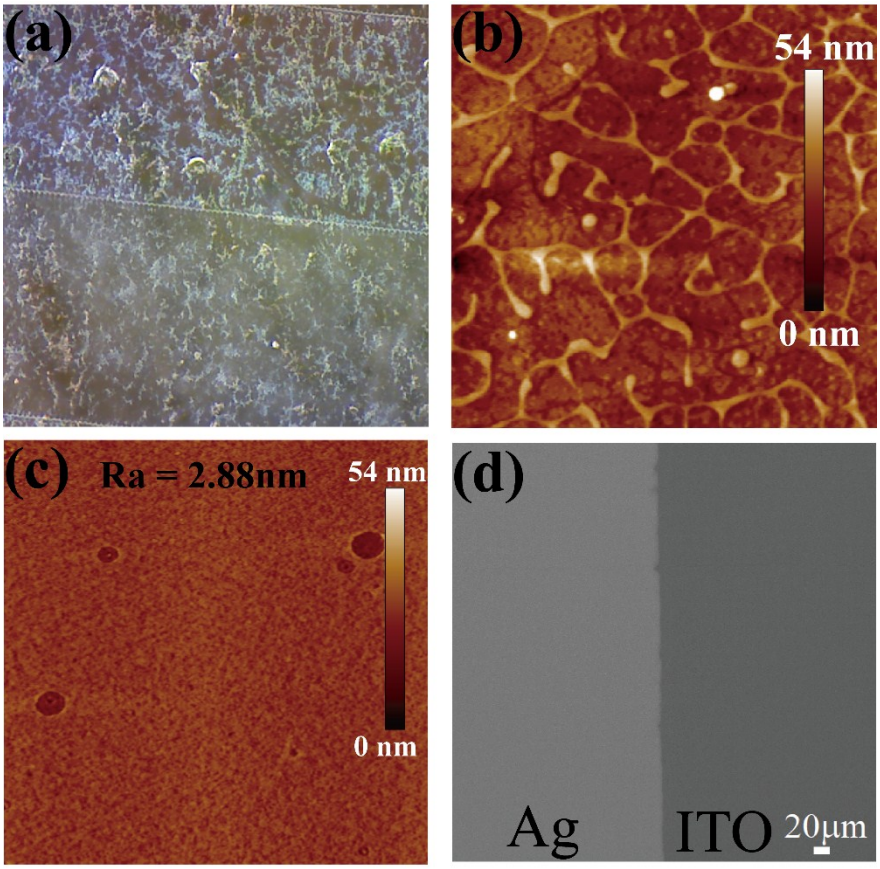

Figure S1. Surface morphologies of the films formed by the mixture with different concentration. (a) Only 15mg/ml PbS QDs. The surface of film is rough and the agglomeration is very serious. (b) The concentration ratio is 5:1 (the concentration of PbS QDs and PMMA was 10mg/ml and 2mg/ml, respectively). It still did not form a uniform membrane. (c) The concentration ratio is 1:1 (the concentration of PbS QDs and PMMA were all 5mg/ml). The film was smooth but PbS QDs were agglomerative. (d) The surface SEM image of the spin coated film. The concentration ratio is 1:5 (the concentration of PbS QDs and PMMA was 2mg/ml and 10mg/ml, respectively). the film was very smooth and the average roughness is 1.41nm (Figure 1(g))

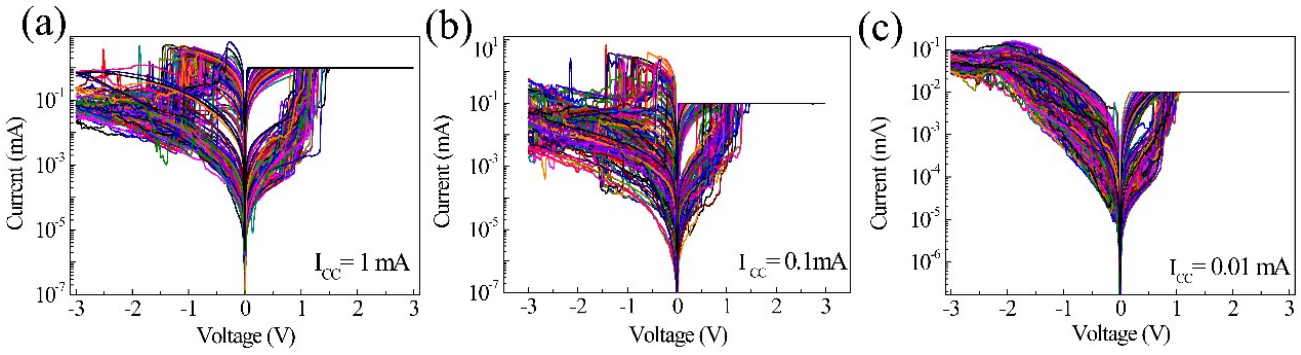

Figure S2. I-V curves of 100 cycle sweeps in different compliance currents of the device.

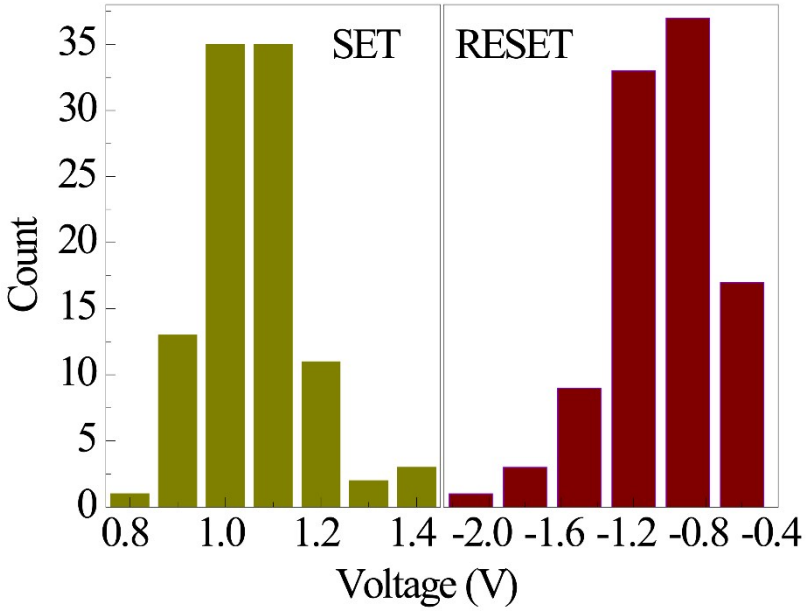

Figure S3. Statistical distribution of the V_{SET} and V_{RESET}. The results are obtained from I–V sweep mode of 100 cycles.

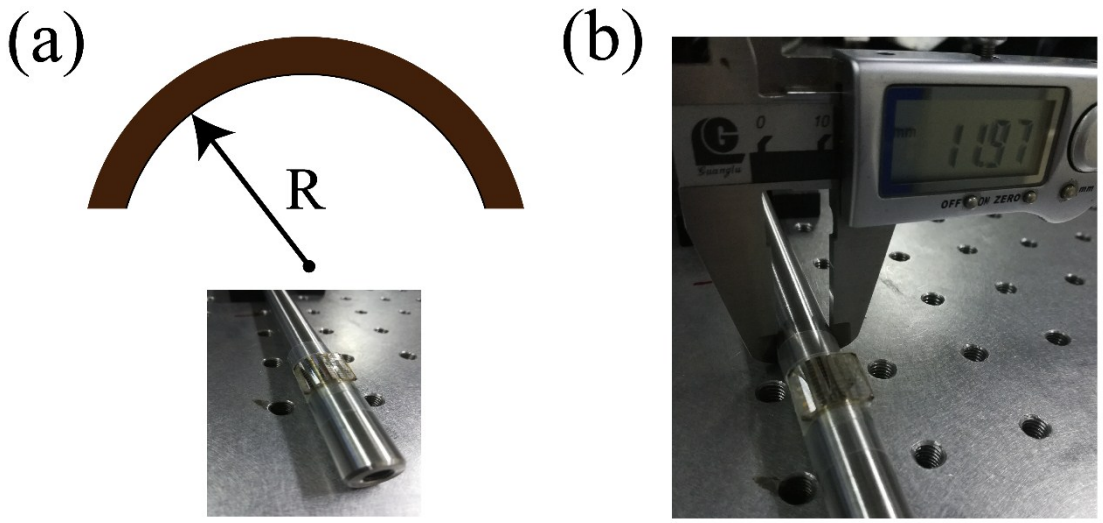

Figure S4. Schematic diagram of bending test.

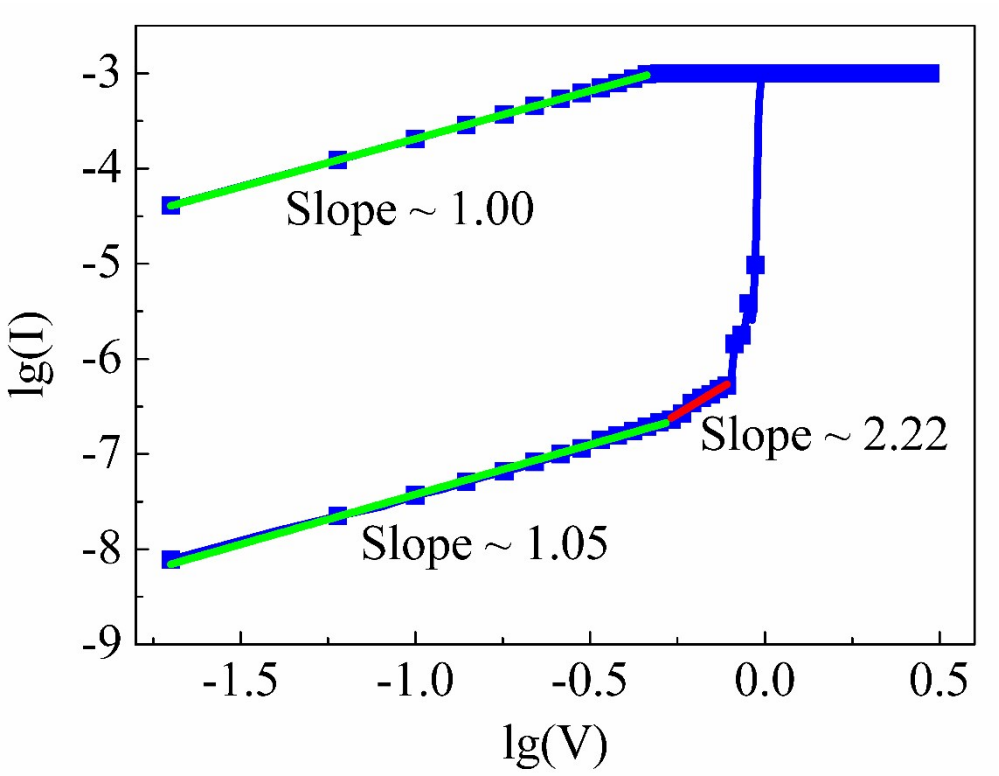

Figure S5. Log I−log V curves in the positive bias region

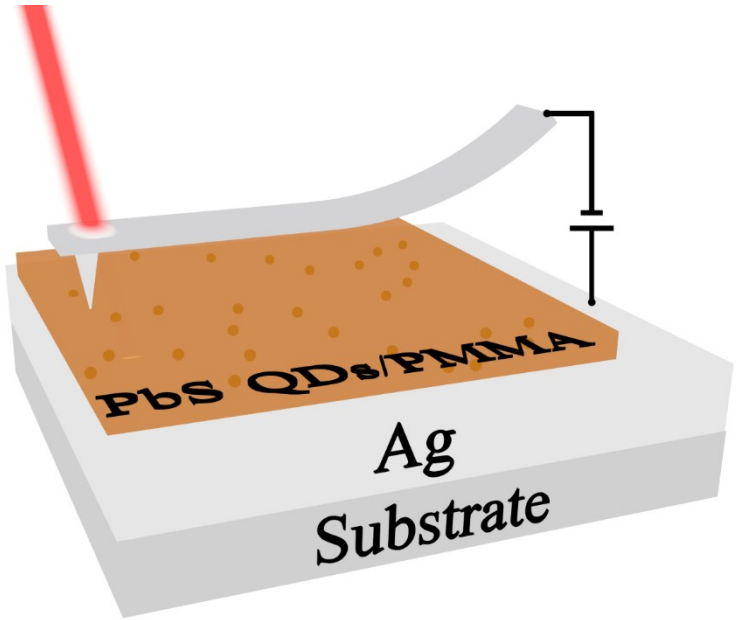

Figure S6. Schematic diagram of CAFM measurement. According to the Guidebook of CAFM, the test base is the positive electrode.