

Supporting information

Overwhelming coexistence of negative differential resistance effect and RRAM

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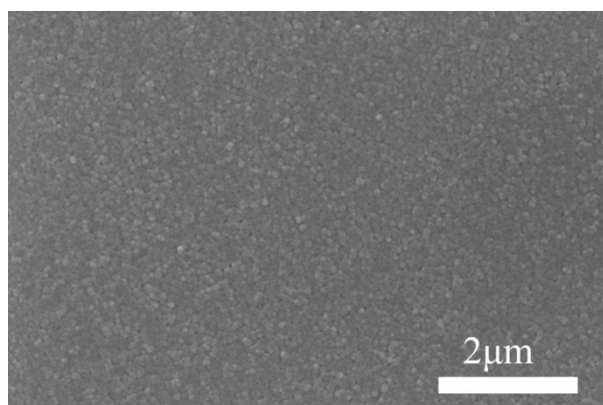


Figure S1. The surface morphology of the CZTSe film.

Figure S1 exhibits the surface morphology of the CZTSe film, the surface showed uniform and dense feature, the grain size ranged between 10~20 nm and no trace of holes or cracks.

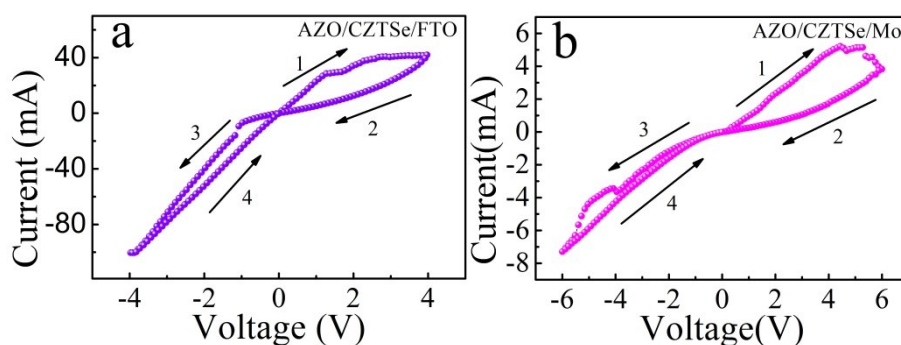


Figure S2. (a) The I-V curve of the AZO/CZTSe/FTO device. (b) The I-V curve of the AZO/CZTSe/Mo device.

In order to further confirm the NRD behavior is derived from the Schottky barrier, we changed the top electrode and bottom electrode shown in Figure S2a and Figure S2b, respectively. The results show that both of the two devices exhibited RS behaviors, but results showed no sign of NRD behaviors.

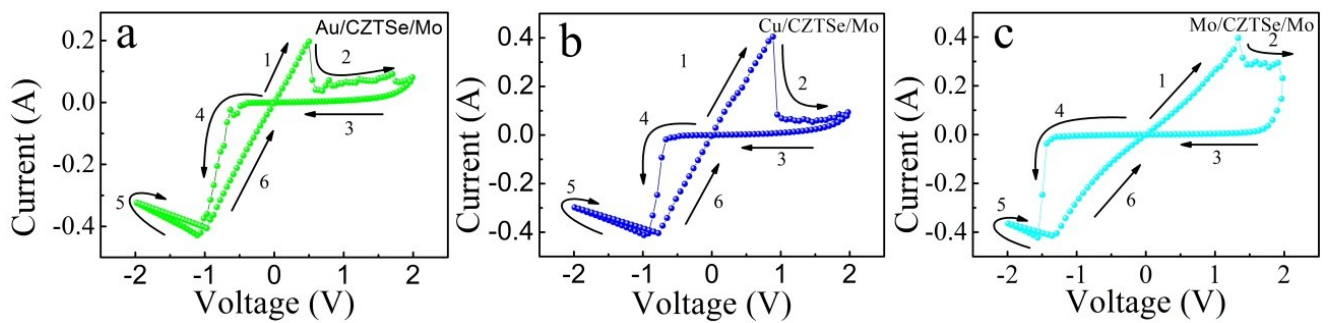


Figure S3. (a) The I-V curve of the Au/CZTSe/Mo device. (b) The I-V curve of the Cu/CZTSe/Mo device. (c) The I-V curve of the Mo/CZTSe/Mo device.

Figure S3a, Figure S3b, Figure S3c exhibit the I-V curve of the Au/CZTSe/Mo device, Cu/CZTSe/Mo device and Mo/CZTSe/Mo device, respectively. The results show that all the devices show coexistence of RS and NRD behaviors and similar to the Ag/CZTSe/Mo device, indicating that structure Schottky barrier at the two sides of the CZTSe thin film is necessary.