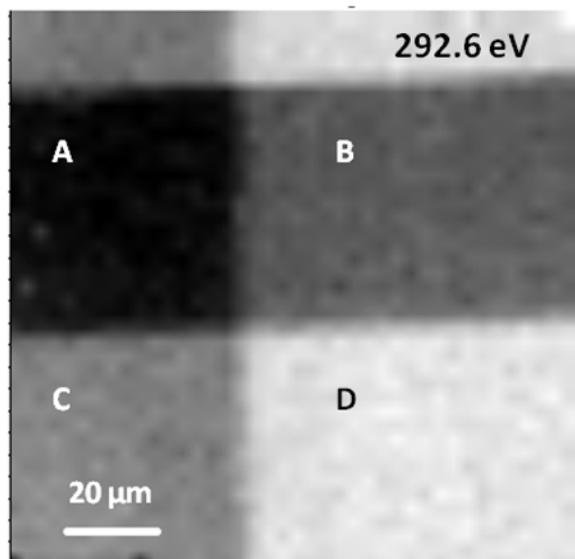


Figure S1 O K-edge XANES spectra of ReRAM in region E (a) and region F (b).

(a)



(b)

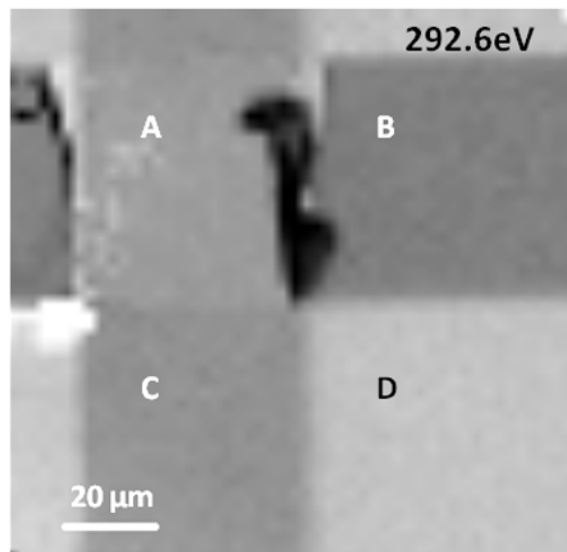


Figure S2 STXM images of GO-ReRAM, before (a) and after applying bias (b). Junction of electrodes, TE, BE, and GO without electrodes are denoted as A, B, C, and D respectively. TE and GO in region A were damaged by Joule heating originated from fast voltage sweep (from 0 to -3 V), and unstable electrical ground.

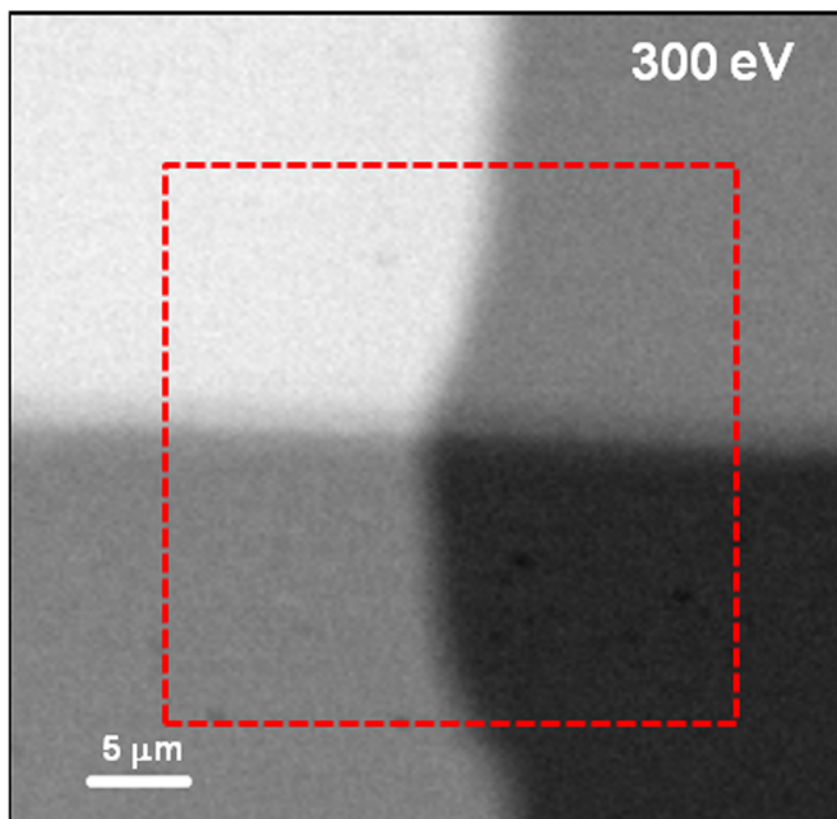


Figure S3 X-ray transmission image ($45\ \mu\text{m} \times 45\ \mu\text{m}$) after stack measurements ($30\ \mu\text{m} \times 30\ \mu\text{m}$, red dash line). There was no carbon deposition and change of contrast at region measured by stack.