Supplementary Materials

The Effect of Carbon Doping on the Crystal Structure and Electrical Properties of Sb_2Te_3

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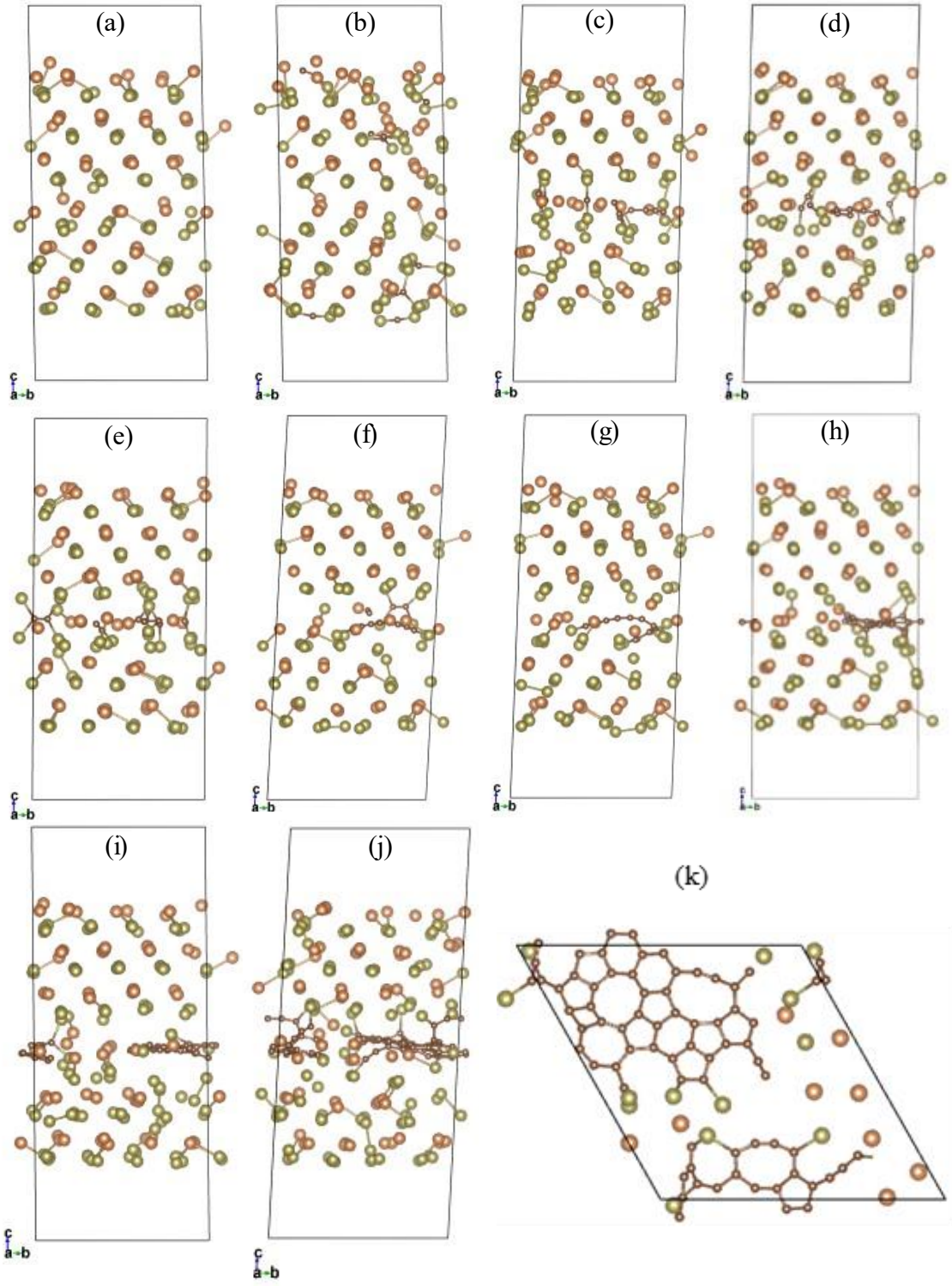

Figure S1. After structural relaxation of different C doping contents and C existing forms. (a) Sb_2Te_3, (b) 12 C atoms are randomly distributed in Sb_2Te_3, (c) 12 C atoms are randomly distributed in the crystal plane, (d) (e) the short C chains (12 C atoms in

total) is distributed in the crystal plane, (f) (g) the long C chain (12 C atoms in total) is distributed in the crystal plane, (h) the long C chain (24 C atoms in total) is distributed in the crystal plane, (i) the long C chain (36 C atoms in total) is distributed in the crystal plane, (j) the long C chain (64 C atoms in total) is distributed in the crystal plane, (k) Top view of C atoms distribution in figure (j). Note that the initial positions of C atoms in Figures (b) and (c) are scattered, and after the structure relaxes, the C atoms gradually converge to form a short C chain.

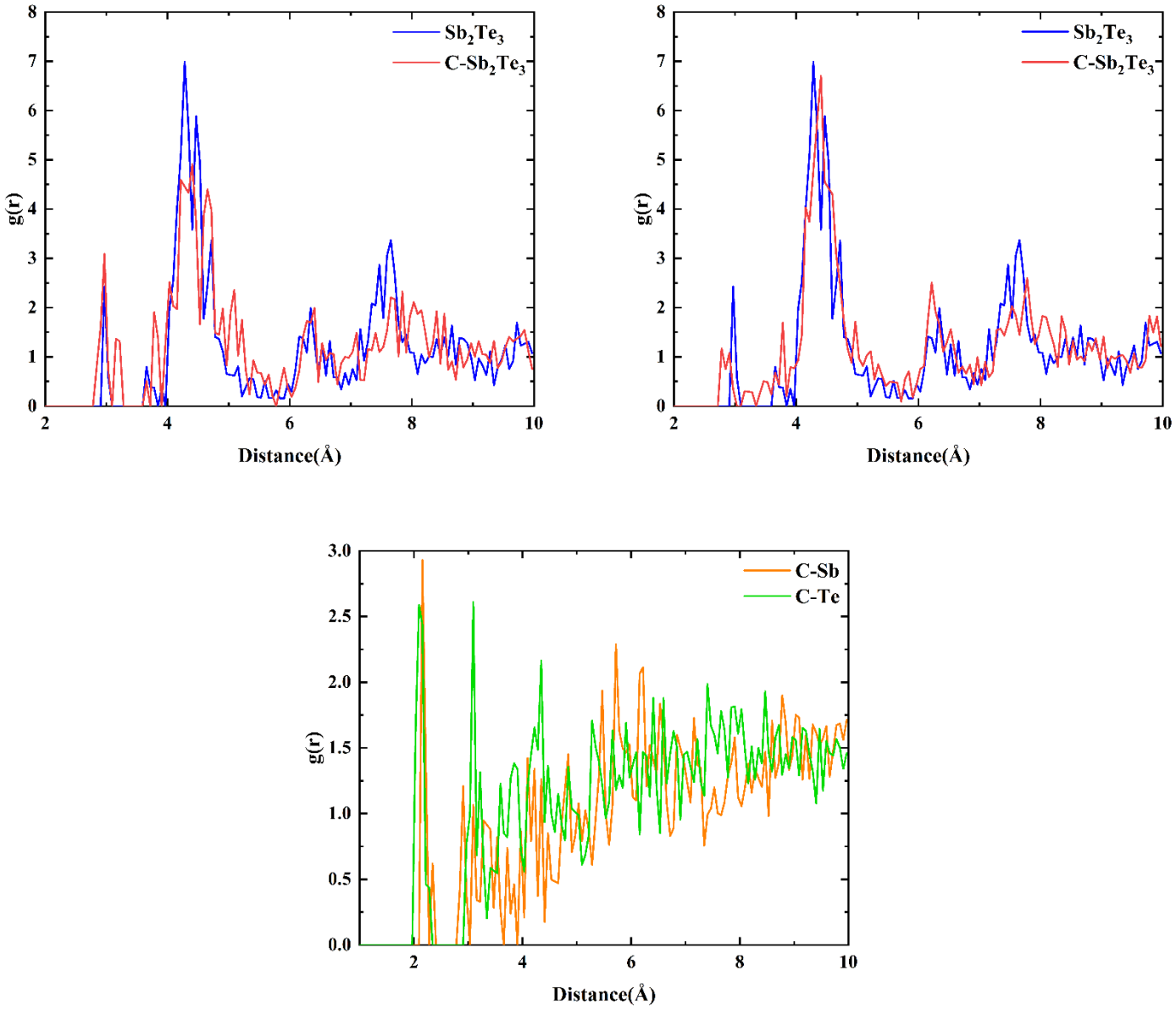

Figure S2. The pair correlation function after structure relaxation. (a)Sb-Sb bond, (b)Te-Te bond, (c)C-Sb bond and C-Te bond.

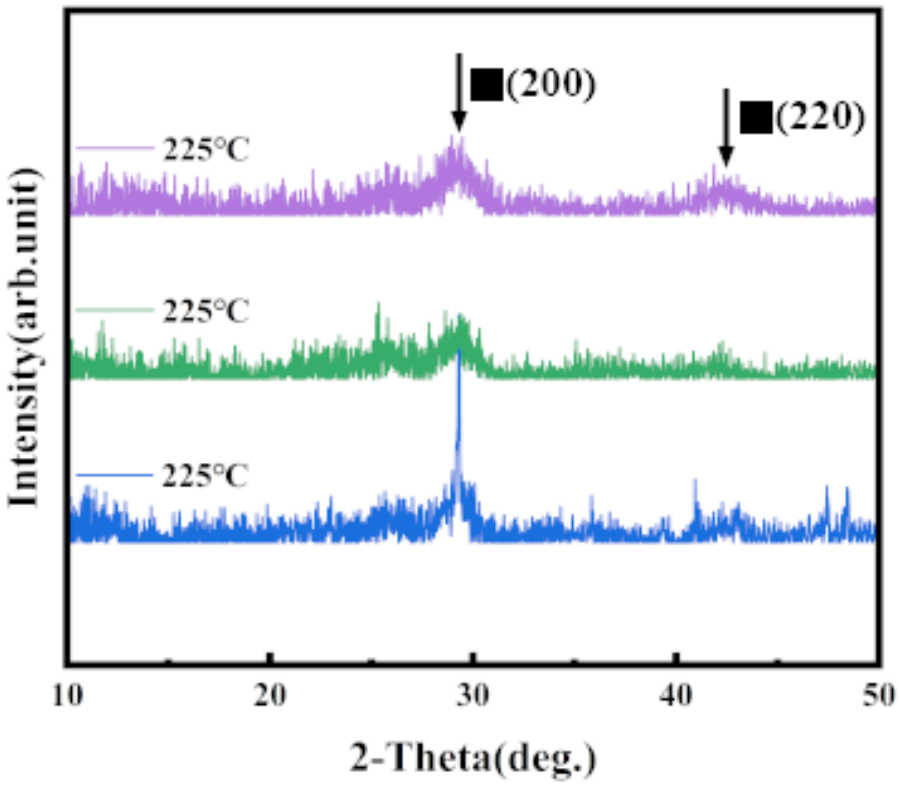

Figure S3. XRD diagram of $C_{40}WSb_2Te_3$ at 225℃.

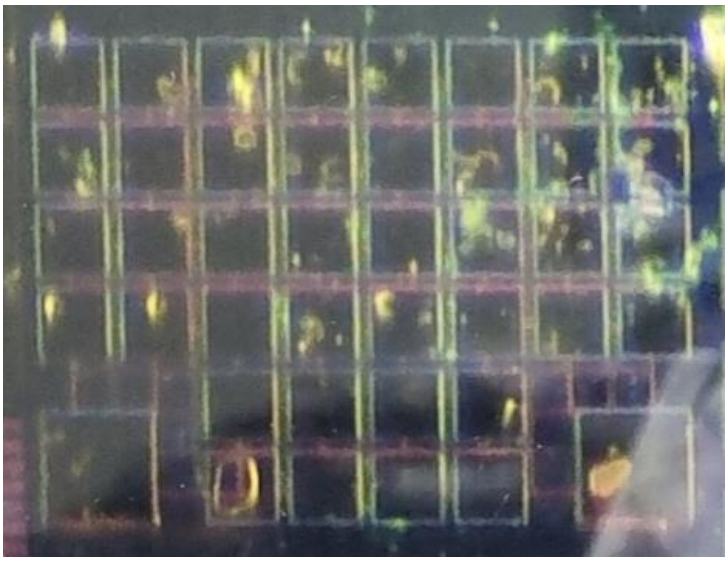

Figure S4. The optical image of the fabricated PCRAM cells.

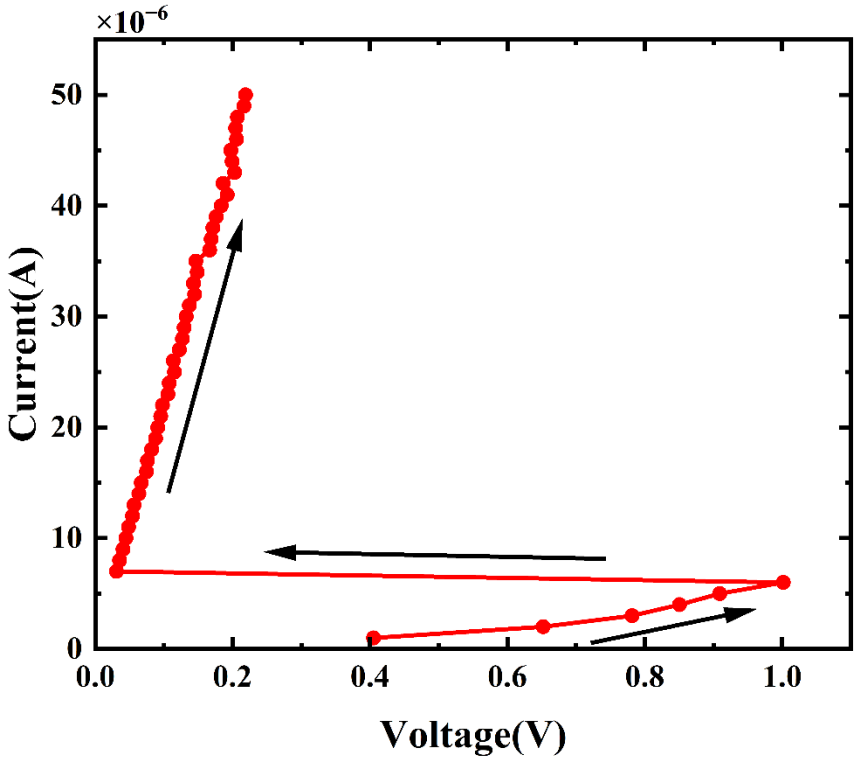

Figure S5. I-V curve of PCRAM unit set from high resistance state to low resistance state by DC current.

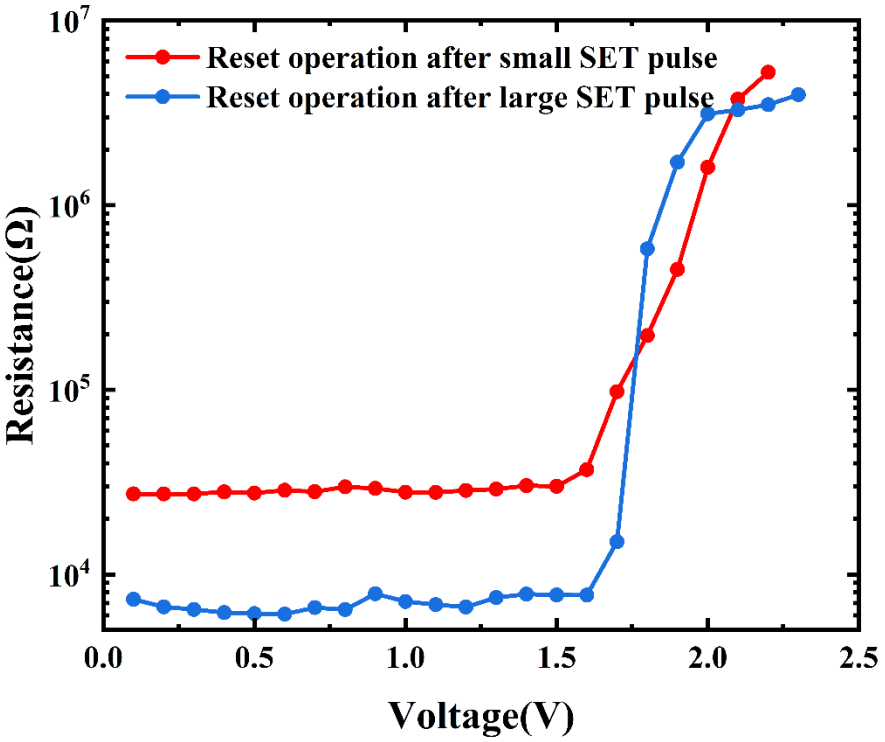

Figure S6. SET the PCRAM in a low resistance state with a large / small set pulse, and then RESET it with a 500ns pulse to obtain a continuously adjustable resistance value.