Electronic Supplementary Material (ESI) for Nanoscale.

Reversible switching in bicontinuous structure for phase change random access memory application

Yan Cheng[1,2*], *Yonghui Zheng*[1], *Zhitang Song*[2]

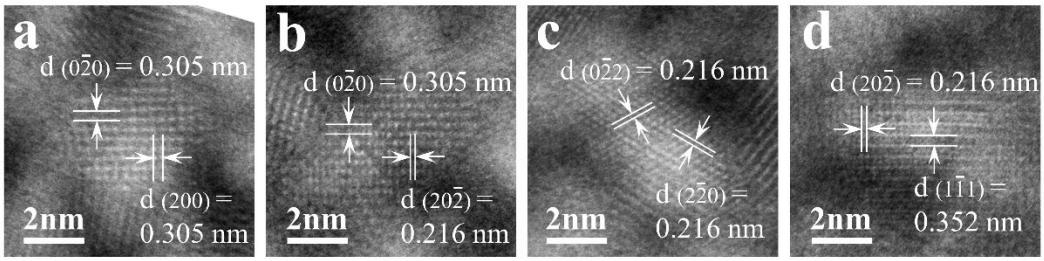
[1]Key Laboratory of Polar Materials and Devices (MOE), Department of Electronics, East China Normal University, Shanghai 200241, China

[2]State Key Laboratory of Functional Materials for Informatics, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, Shanghai 200050, China

[*]Correspondence and requests should be addressed to Y. C (email: ycheng@ee.ecnu.edu.cn)

Movie S1. A 3D volume rendering of crystallized SST lamina reconstructed ($80\times80\times50$ nm^3) through Avizo 3D software, showing a random even contrast in every HAADF-STEM slice. A nano-bicontinuous structure consisting of Si (cyan) and Sb/Te (orange) is also shown according to the HAADF contrast variation.

Fig. S1 Enlarged HAADF-STEM images taken from the selected grains in Figure 2, fitting well with (a) [001], (b) [101], (c) [111] and (d) [121] zone axis by using the metastable f-lattice index.



area d: [001] **area e: [101]** **area f: [111]** **area g: [121]**

Fig. S2 A protype HREM image of thermal induced crystallized SST film, in which the crystalline nanograins (denoted by red dashed lines) are surrounded by the neighboring amorphous areas (denoted by blue dashed lines). A [001] f-phase is indexed in the center area, and its lattice parameter is also consistent with the reported value (a = 6.10 Å).

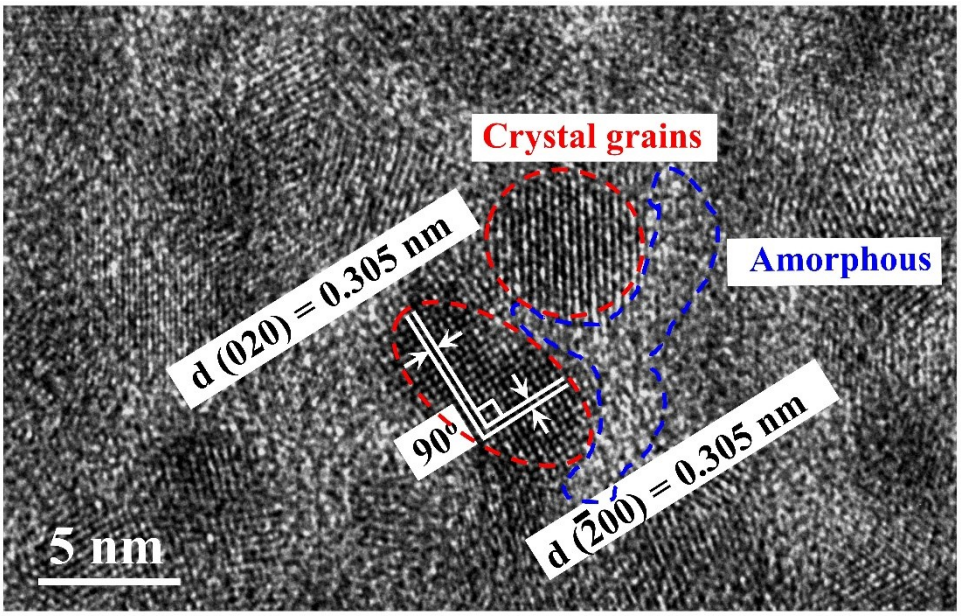


Fig. S3 The microstructure of laser induced crystallized SST film. (a) The crystallized SST spot was induced by a laser beam, whose size is around 400× 600 nm^2. The inset bottom SAED pattern extracted from the crystallized SST spot shows that it still belongs to f-phase. (b) The enlarged HREM image from the crystallized SST spot, showing a mixture of crystallized ST area and amorphous Si area, similar to the thermal induced crystallized SST film.

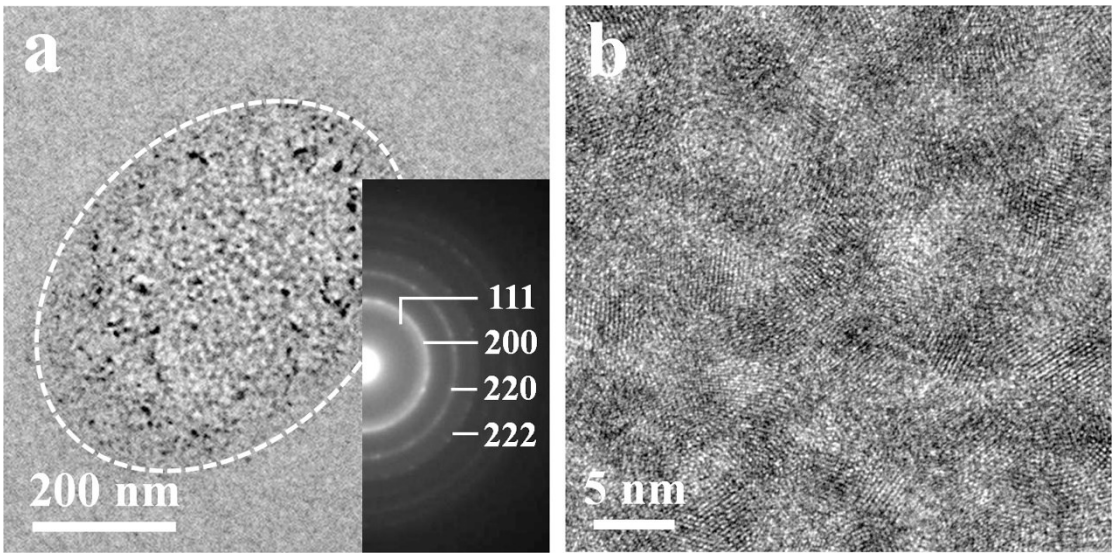


Fig. S4 (a) The morphology of the laser induced re-amorphous SST film, in which aluminum (Al) sacrificial layer was attached. Tremendous of dark spots can be detected ascribing to the crystallized Al nanograins, impeding the investigation of the re-amorphous area. (b) The SAED pattern of irradiated region, the sharp rings or spots belongs to crystallized Al lattice, and the diffused patterns belongs to SST amorphous. (c) The SAED pattern of unirradiated region, apart from the crystalline Al lattice, some sharp rings or spots are found to be consistent with f-phase SST phase.

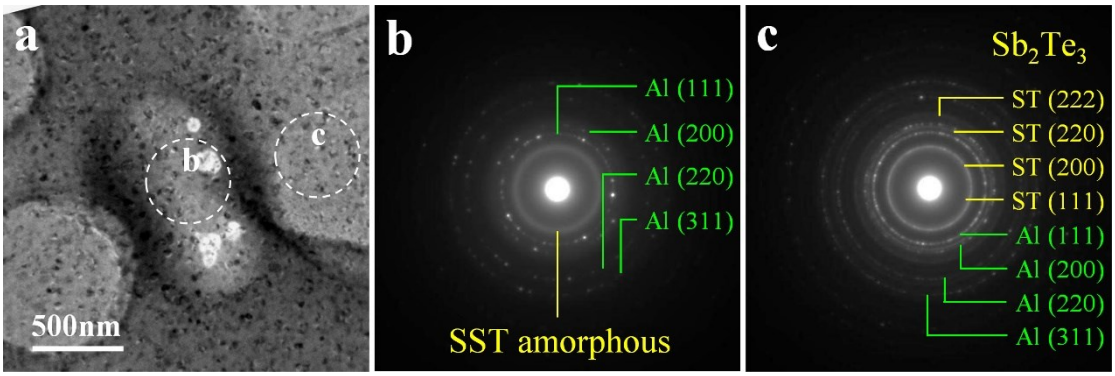


Fig. S5. The endurance characteristics of the PCM device based on SST material.