

Supporting Information

Increasing Trapped Carrier Density in Nanoscale GeSeAs Films by As Ion Implantation for Selector Devices in 3D-Stacking Memory

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This Supporting Information is mainly to verify the stability of the Ge/Se ratio before and after implantation (Fig. S1 and Table S1), the stability of the amorphous structure (Fig. S2), and the change of Raman spectra with different film thicknesses (Fig. S3).

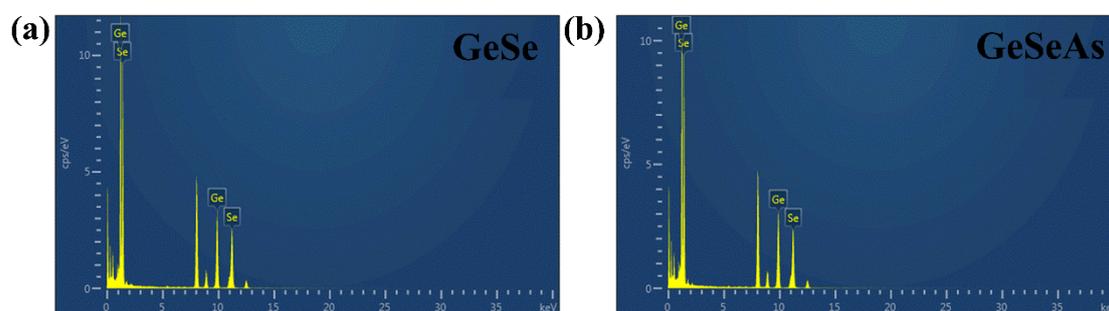


Fig. S1. The Energy dispersive X-ray spectrometry (EDS) results of (a) the GeSe film and (b) the GeSeAs film (only considering Ge and Se elements).

Table S1. EDS results of the GeSe and GeSeAs films (only considering Ge and Se elements).

	Ge (atom%)	Se (atom%)	Ge/Se Ratio
GeSe	50.5	49.5	~1:1
GeSeAs	50.4	49.6	~1:1

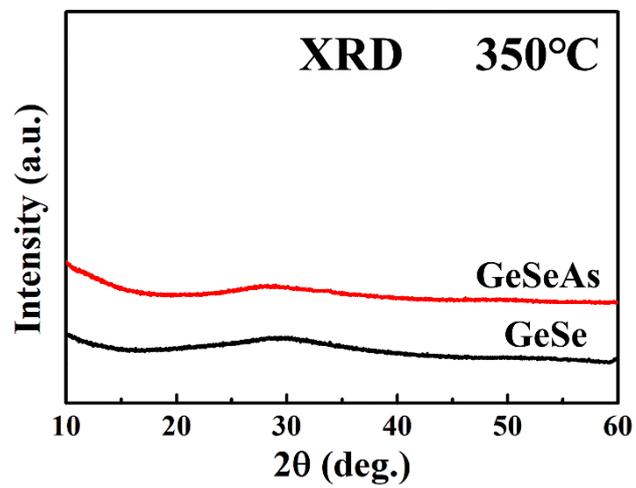


Fig. S2. The X-ray diffraction (XRD, Burker D8 Discover) results of the GeSe and GeSeAs films under 350°C annealing temperature.

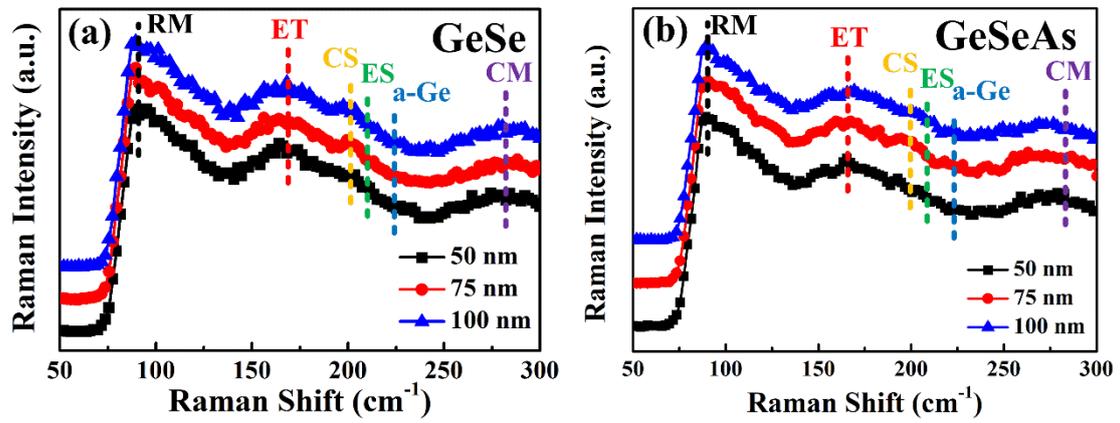


Fig. S3. Raman scattering spectra of (a) GeSe and (b) GeSeAs films with different thicknesses (50, 75, and 100 nm). (RM: Se₈ rings, ET: Ge₂(Se_{1/2})₆ ethane-like units, CS: Ge₂(Se_{1/2})₆ corner-sharing tetrahedra, ES: Ge₂(Se_{1/2})₆ edge-sharing tetrahedra, a-Ge: Amorphous Ge and CM: Se_n chain)