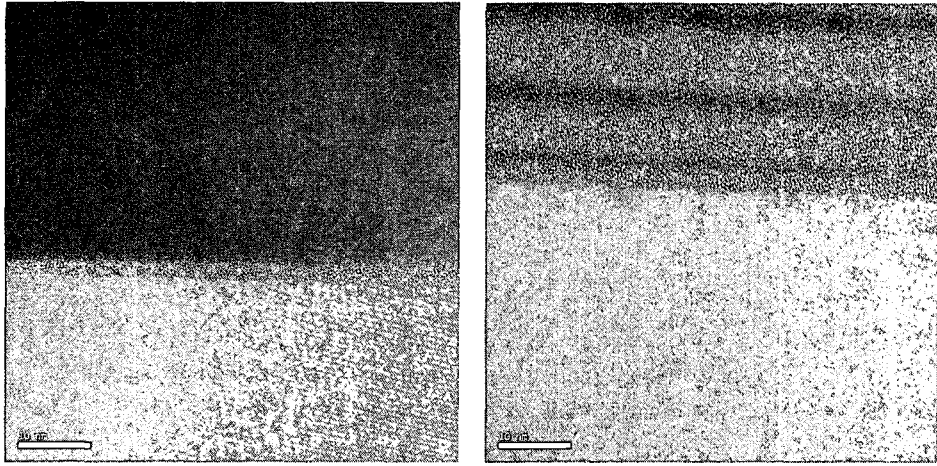


In-situ HVEM study of the phase change behaviors of the  
amorphous  $\text{Ge}_2\text{Sb}_2\text{Te}_5$  thin films

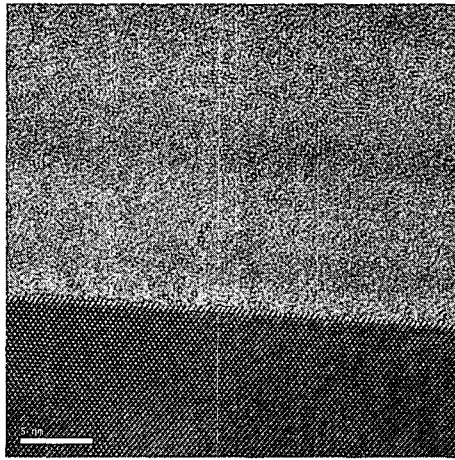
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Phase change behaviors from the amorphous state to the meta stable crystalline state were observed with HVEM during in-situ annealing the amorphous GST thin film on the Si wet oxide layer and Si(001) substrate. From the observed microscopic images of phase change, we could show the amorphization and crystallization at the interface region of GST and Si wet oxide layer with different annealing condition. We also could verify the hexagonal structures of GST thin film known as stable crystallized state, which showed the 3-fold symmetry in the electron diffraction patterns before thermal treatment. In the phase state of the amorphization at room temperature, material interdiffused Si wet oxide layer was observed, of which thickness was evolved to be reduced as raising the annealing temperature. Finally, the inclusion of the intermixed oxide layer to the amorphous GST thin film was verified during this phase change step. As proceeded the thermal annealing processes, the crystallization in the meta-stable phase domain layer was observed.



(a)

(b)



(c)

Fig. 1. Cross section HVEM images of amorphous  $\text{Ge}_2\text{Sb}_2\text{Te}_5$  thin films at (a) room temperature, (b)  $135^\circ\text{C}$  and (c)  $350^\circ\text{C}$ .