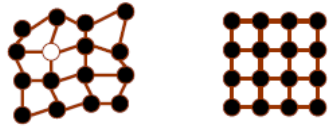
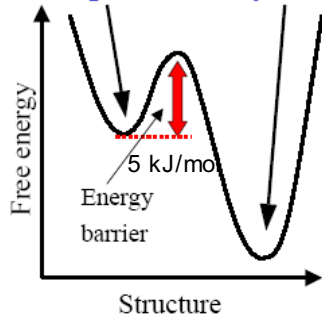


New phase change memory materials

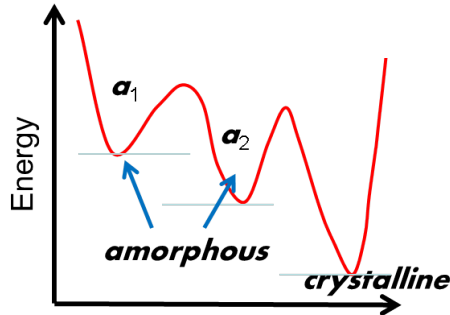
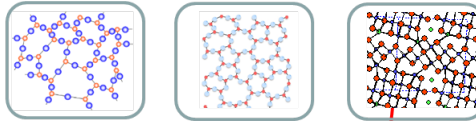
2 stable states



Amorphous Crystalline



3 stable states

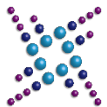


V		
oxygen	8	} Oxides
O	15.999	
sulfur	16	} Chalcogenides
S	32.065	
selenium	34	
Se	78.96	
tellurium	52	
Te	127.60	

Traditional 2-state GST (Ge-Sb-Te)
switching speed = nanosecond

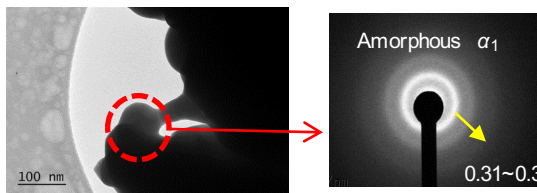
New 3-state material $K_2Sb_8Se_{13}$

- Three different resistance states
- Three different band gaps
- Alloying and substitutional doping

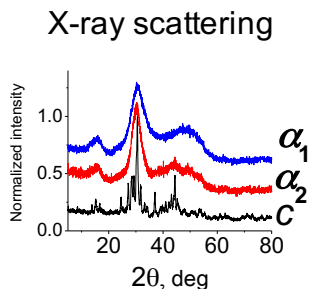


New phase change memory materials

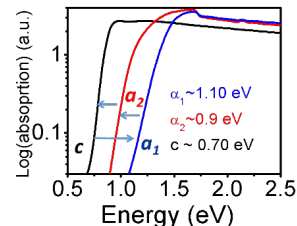
- 3-states $K_2Sb_8Se_{13}$ observed in calorimetry
- PLD a - $K_2Sb_8Se_{13}$ films prepared
- Resistivity of α_1 films $\sim 10^7$ Ohm-cm
- SEM/EDS: film composition consistent with $K_2Sb_8Se_{13}$



TEM



Band gaps



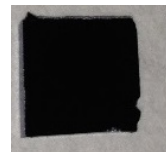
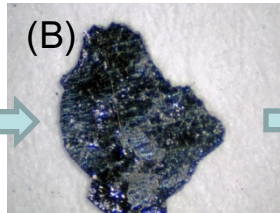
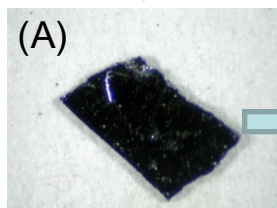
Bulk material

Crystal

Amorphous, α_1

Thin Film

Film on silicon substrate



Target for film growth