AuSb Induced Crystallization of Germanium Thin Films

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Introduction

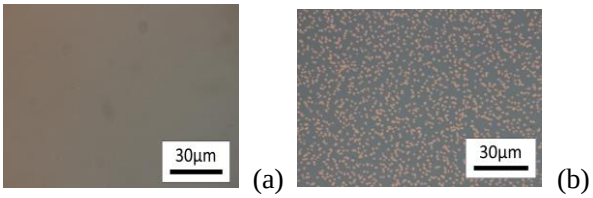
Low temperature (≤ 300˚C) growth of polycrystalline germanium thin film is realized by layer exchange mechanism using AuSb alloy. Sb is added to the Au layer in the expectation that it might lower the crystallization temperature, since Sb is known to lower the eutectic temperature of AuGe alloy. Moreover, if Sb is incorporated in the resulting crystalline Ge layer, it might be possible to realize an n-type crystalline Ge thin film at low temperature.

Experiment

20nm Au-0.5% Sb alloy film was evaporated onto a Si wafer covered with 100nm of thermally oxidized SiO_2, which was followed by a sputter deposition of 20nm of amorphous germanium. A bilayer with 20nm of pure Au is also prepared as a reference. The samples were then annealed up to 150-300 ˚C.

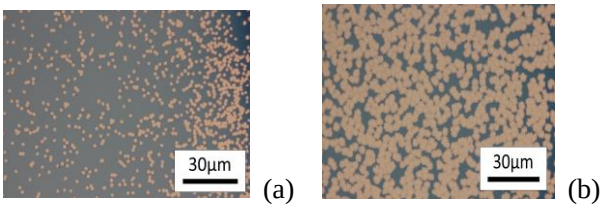
Results and Discussion

Fig 1 (a) and Fig 1 (b) are optical microscope images of the samples after 160˚C annealing. It can be observed that nucleation starts to occur for Ge/AuSb, but not for Ge/Au. Fig.2 (a) and (b) are optical microscope imagies of the samples after 170˚C annealing. Surface segregation of Au is observed clearly for Ge/AuSb. In the Raman spectra of the two samples annealed at 250˚C , it can be observed that the FWHM of the AuSb sample is smaller than that grown with Au implying a better crystal quality.



(a) (b)

Fig.1 Optical microscope images after annealing at 160˚C for (a) Ge/Au and (b) Ge/AuSb.



(a) (b)

Fig.2 Optical microscope images after annealing at 170˚C for (a) Ge/Au and (b) Ge/AuSb.

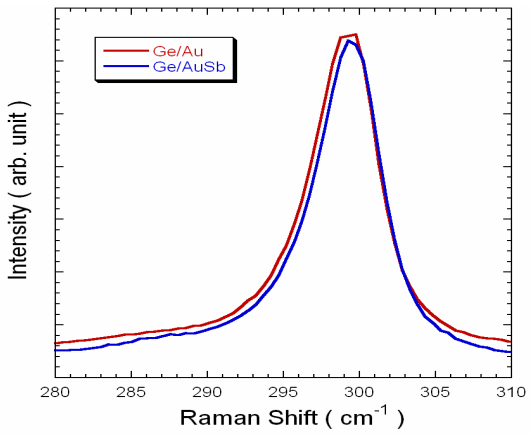


Figure 3 Raman spectra of Ge/Au and Ge/AuSb after annealing at 250˚C.

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