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Phase separation of In doped SbTe films

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The $In_{0.5}Sb_2Te_{2.9}$, $In_{2.6}Sb_2Te_{2.9}$ and $Sb_2Te_{2.7}$ films were deposited by ion beam sputtering deposition to find out the effect of In. The sheet resistance of $In_{2.6}Sb_2Te_{2.9}$ film did not change at 220 ^oC while the resistance of $In_{0.5}Sb_2Te_{2.9}$ and $Sb_2Te_{2.7}$ films was dropped abruptly at 170 ^oC. From x-ray diffraction, In_2Te_3, Sb and In_3SbTe_2 phases separated in the $In_{2.6}Sb_2Te_{2.9}$ film with annealing above 270 ^oC. However, $In_{0.5}Sb_2Te_{2.9}$ and $Sb_2Te_{2.7}$ films showed only SbTe phase. In addition, x-ray photoelectron spectra of $In_{2.6}Sb_2Te_{2.9}$ film showed low binding energy shift of Sb 3*d* and In 3*d* peaks after the annealing. This is due to the bond energy difference among the constituent atoms in the film. Moreover, the density of state near Fermi level decreased as In content increased. This is originated from In 5*p* valence state which has only one electron. The change of valence state affects to the electrical resistivity as shown in sheet resistance data. The atomic force microcopy images showed the enhancement of “nucleation-dominated” crystalline growth with In incorporation.