Fluence dependence of nanosize defect layers in arsenic implanted HgCdTe epitaxial films studied with TEM/HRTEM

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We report on the results of comparative study of fluence dependence of defect layers in molecular-beam epitaxy-grown epitaxial film of *p*-$Hg_{1-x}Cd_xTe$ (x=0.22) implanted with arsenic ions with 190 keV energy and fluence 10^{12}, 10^{13}, and 10^{14} cm^{-2}. The vacancy-doped *p*-type samples were obtained with thermal annealing (220 °C, 24 h) at low mercury pressure in helium atmosphere of as-grown *n*-type sample. The microstructure observations were performed with transmission electron microscopy in bright field and high-resolution modes. It was found that after the implantation radiation-damaged areas in all studied samples were very similar and consisted of three characteristic sub-layers: a sub-surface layer with low defect density, a deeper layer with big dislocation loops and a deeply buried layer with small dislocation loops. The characteristic sizes of these regions and the density of radiation-induced nano-defects (dislocation loops) depended on the ion fluence. These data confirm the results of the electrical measurements of the concentration of radiation donor defects that were created by interstitial mercury atoms, which were released under implantation, with dislocation loops.