

MBE growth of ZnO Epilayers with Annealed Initial Zn Layers and its Properties

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ZnO epilayers with initial Zn layers were deposited on p-type Si (100) by plasma-assisted molecular beam epitaxy (PA-MBE). The initial Zn layers prior to the growth of the ZnO epilayers were deposited on the Si substrates for 4 minutes and then annealed at the different substrate temperature (from 500 to 700 °C) in oxygen plasma. Room temperature (RT) photoluminescence (PL), X-ray diffraction (XRD), and scanning electron microscopy (SEM) were carried out in order to investigate the optical and structural properties of the ZnO epilayers with annealed initial Zn layer. The PL spectra show near-band edge emission (NBEE) at 3.3 eV and deep-level emission (DLE) around 1.9 to 2.1 eV. The PL intensity ratio of the NBEE to DLE for the sample annealed at 500 °C is the largest. The NBEE peak position is blue-shifted with increasing the annealing temperature. The ZnO (002) peak intensity of the XRD spectra was relatively dominant. The PL spectra, the XRD spectra, the strain, and the surface morphology for the ZnO epitaxial layers are changed by the annealing process.