

Paper presented at ISPN Conference 2003

Effects of annealing of MgO buffer layer on structural quality of ZnO layers grown by P-MBE on c-sapphire

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Abstract

We have investigated effects of annealing of MgO buffer layer on structural quality of ZnO layers grown by plasma assisted molecular beam epitaxy (P-MBE) on c-sapphire. ZnO layers were characterized by atomic force microscopy (AFM), high resolution X-ray diffraction (HRXRD) and cross sectional transmission electron microscopy (TEM). AFM images show that annealing of a low temperature (LT) MgO buffer at high temperatures enhanced the surface migration of adatoms, leading to the formation of larger terraces and smoother surface morphology, as indicated by the reduction of rms values of roughness from 0.6 nm to 0.3 nm. HRXRD and TEM experiments reveal that the dislocation density of ZnO layers is reduced from $5.3 \times 10^9 \text{ cm}^{-2}$ to $1.9 \times 10^9 \text{ cm}^{-2}$ by annealing a LT-MgO buffer. All of those features indicate the structural quality of ZnO layers was improved by annealing a LT-MgO buffer layer.

KEYWORDS/PACS CODES: ZnO, plasma- assisted MBE /81.05.Dz, 81.15.Hj

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