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Abstract

For the purpose of controlling the wafer bow of GaN-on-Si structure, *in situ* curvature transient during the growth of a GaN layer on an AlN interlayer was investigated systematically by estimating the compressive strain applied to the GaN layer with the progress of the layer growth. The compressive strain was dependent on the morphology of the GaN surface prior to the growth of the AlN interlayer. It was found that the transition sequence from GaN growth to AlN growth induces roughening of the GaN surface and both high NH_3 partial pressure and the short transition time were effective for reducing the roughness of the GaN surface beneath the AlN interlayer. The improved transition sequence increased the compressive strain in GaN by a factor of 2.5. The AlN grown at the same temperature as that of GaN was beneficial in both better surface morphology and the reduction of the transition time between GaN growth and AlN growth. With this high-temperature AlN interlayer, its thickness is another important factor governing the compressive strain in GaN. To get AlN relaxed for applying the compressive strain to GaN, the AlN layer should be thicker but too thick layer after relaxation results in surface roughening, which in turn introduces defects to the overlying GaN layer and reduces the compressive strain by partial lattice relaxation of GaN.