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Structural and compositional determination of AlGaN/AlN/Si(111) thin films

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We studied the atomic structures of AlGaN/AlN/Si (111) thin films grown by a chemical vapor deposition in an ultrahigh vacuum chamber. The in-plane epitaxial relationship was AlGaN // Si. The Al composition of the AlGaN films is determined from the reflection and is somewhat different from the gas ratio of TMAl to TM[Ga+Al]. For whole Al compositional range, the AlGaN thin films were tensile strained. As Al contents increased, the crystalline quality decreases in both out-of-plane and in-plane directions. The AlGaN thin films have long range atomic ordering with 2ML periodicity from the strong (0001) SSR and the order parameter, S is obtained from the integrated intensity ratio, that is maximized upto 0.06 near x=0.5.