Controlling the stress of growing GaN on 150-mm Si (111) in an AlN/GaN strained layer superlattice

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ABSTRACT

For growing a thicker GaN epilayer on a Si substrate, generally, a larger wafer bowing with tensile stress caused by the mismatch of thermal expansion coefficients between GaN and Si easily generates a cracked surface during cool down. In this work, wafer bowing was investigated to control stress by changing the thickness of a GaN layer from 18.6 to 27.8 nm in an 80-paired AlN/GaN strained layer superlattice (SLS) grown on a 150-mm Si (111) substrate. The results indicated that wafer bowing was inversely proportional to the total thickness of epilayer and the thickness of the GaN layer in the AlN/GaN SLS, since higher compressive stress caused by a thicker GaN layer during SLS growth could compensate for the tensile stress generated during cool down. After returning to room temperature, the stress of the AlN/GaN SLS was still compressive and strained in the a-axis. This is due to an unintended AlGaN grading layer was formed in the AlN/GaN SLS. This AlGaN layer reduced the lattice mismatch between AlN and GaN and efficiently accumulated stress without causing relaxation.

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REFERENCES
References