Initial Growth Mechanism for Two-Step GaN Growth on Sapphire Substrate by MOCVD

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Initial growth processes for two step GaN growth on sapphire substrate by atmospheric MOCVD method are investigated.

In chapter 1 and 2, a background, a purpose, an experimental method and a characterizing method of this investigation are described, and an optimizing process for growth condition of second step HT-GaN layer is described.

In chapter 3, effects of deposition conditions of first step GaN buffer layer upon the properties of HT-GaN growth layer are described. It is found that GaN buffer layers are recrystallized with coalescence and reconstruction and reevaporated by the thermal annealing. It is found that both deposition temperature, the V/Ⅲ ratio, thickness and annealing time of buffer layer have to be optimized simultaneously in order to obtain high quality HT-GaN growth layer. It is found that the crystallinity of GaN growth layer is dominated by the surface morophology and crystallinity of annealed buffer layer.

In chapter 4, effects of deposition conditions of first step AIN buffer layer upon the properties of HT-GaN growth layer are described. It is found that recrystallization rate of AION buffer layer is slow and a low V/ Ⅲ ratio of buffer layer is necessary in comparison with the case of GaN buffer layer.

In chapter 5, effects of initial nitridation of sapphire substrate upon the properties of HT-GaN growth layer are described. It is found that the difference of surface morphology of GaN growth layers means the difference of polarity of GaN growth layers. It is found that substrate nitridation leads to hexagonal faceted surface with (0001)N plane, while the deposition of buffer layer results in mirror surface with (0001)Ga plane.

In chapter 6, this investigation is concluded.