Chapter 1 Introduction

The inverted pyramid V shape defects on nitrides surfaces have been widely discussed[1~5,11]. The origins of V-defect formation in nitrides had been classified by H. K. Cho[1] into three categories. For most cases, V-defects are generated at vertex of threading dislocation. Stacking mismatch boundary generated V-defects appear in multi-quantum wells structure, while those generated by inversion domain appear in AlGaN flim with higher Al compositions.

Spectral phenomenons of V-defects on ternary nitrides, such as InGaN and AlGaN, have been reported. Wu *et al.*[2] found a defect-related feature (at 2.83eV) near the main peak of InGaN/GaN multi-quantum wells (at 2.97eV) by cathodoluminescence (CL) analysis. Jeong *et al.*[3] found that the yellow luminescence (YL) at 2.25eV only occurred inside V-defects in InGaN/GaN MQWs. Huang *et al.*[4] indicated a V-defect related transition at 350nm in addition to the near-band edge transition at 336nm in AlGaN film from micro-PL spectra. However, seldom studies discussed the Raman spectral behaviors of V-defects on nitrides films.

Since V-defect appears as an inversion pyramid of Epitaxial Laterally Overgrown (ELO) structure, it is believed that these two structures are formed by the same cause[5], and their Raman modes behave similarly. In Kuball *et al.*'s[6] study, forbidden Raman signals were found in the window region of the GaN ELO structure. They imputed the forbidden modes to the breaking of the selection rule, because of the high defect density in the window region of ELO.

Hao *et al.*'s[7] also discussed the forbidden Raman modes at the coalescence edge on the GaN ELO structure. They suggest that the observation is due to the superposition of back-scattering and right angle scattering from the hill-like landform.

In this thesis, we report the AFM images and μ-Raman spectra of V-defects in GaN films with different doping concentration and V-defect size. This thesis contains five chapters including the present one. In chapter 2, the theoretical background of the wurtzute structure, Raman scattering, and model of LO phonon plasmon coupling is presented for interpreting our results. Experimental conditions and samples preparation are presented in chapter 3. In chapter 4, we show the experimental results and discussion. Simulations of phonon plasmon interaction provide good fit to the observed Raman spectra and give a reasonable explanation of the variations. Finally, the conclusions obtained from this investigation are summarized in chapter 5.