

Raman Spectroscopy of GaN films on (001)- and (110)-oriented GaAs substrates

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Structural phases in the GaN films grown on the (001)- and (110)-oriented GaAs substrates were investigated by μ -Raman spectroscopy with the excitation wavelengths of 473, 532 and 633 nm. Raman spectra show a significant shift of phonon modes between the films on the (001)- and (110)-oriented substrates. For the films on the (001)-oriented substrates, phonon mode of cubic-TO was clearly observed at 553 cm^{-1} . On the other hand, the films on the (110)-oriented substrates showed a higher intensity of hexagonal- E_2 -high localized at 568 cm^{-1} . Furthermore, Raman spectra, which measured using different excitation wavelengths of 473, 532 and 633 nm, show that the phonon mode observed at a higher wave number is significantly shifted from 736 to 739 cm^{-1} for the wavelengths of 473, 532 and 633 nm, respectively. It is well known that the phonon modes localized at 736 and 739 cm^{-1} are attributed to hexagonal- A_1 (hexagonal-LO) and cubic-LO, respectively. While Raman shift of cubic-TO at 553 cm^{-1} is found to independence on the excitation laser wavelengths. These indicate that the cubic-LO phonon mode is sensitive to the excitation wavelength of 633 nm compared to other excitation wavelengths. Another possibility is due to the different of penetration depths of the laser wavelengths. It is interpreted that the GaN films exhibited more hexagonal phase in the region close to the GaN surface region. In contrast, the GaN films exhibited more cubic phase at the region near the GaN/GaAs interface.

Author: Mr PRAIGAEW, Pitshaya (Chulalongkorn University)

Co-authors: Prof. ONABE, Kentaro (The University of Tokyo); Dr NUNTAWONG, Noppadon (National Electronics and Computer Technology Center (NECTEC)); Prof. SANORPIM, Sakuntam (Chulalongkorn University)

Presenter: Mr PRAIGAEW, Pitshaya (Chulalongkorn University)

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