In-Plane Diffraction Analysis for Twist/Twin Structure of Non-polar A-plane GaN

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Commercially used LEDs are composed of multi-stacked epi layers grown on C-plane sapphire or C-GaN free standing substrates. Onto such symmetric substrates, epi layers can be easily grown. But these types of LEDs show some intrinsic disadvantages. For example, when using C-plane as a substrate, the devices should suffer form strong polarization effect along the active layers where the radiative recombination occurred. This phenomenon is originated from the fact that GaN is wurzite structure material. Polarization effect can make not only the device's efficiency decreased but also the wavelength shifted to red region, because the electrons and holes are separated by this polarization effect so that the recombination efficiency is drastically decreased.

In order to reduce and avoid the polarization effect on the active region, the promised method is to use non-polar plane as a substrate. Already the performances of non-polar based device have been revealed as outstanding by other groups. But the structural properties of these non-polar epi layers are not well understood.

Especially, with respect to isotropic characteristics, a-plane GaN epi layer show strongly separated two directional properties, those are c- and m-plane directions. So, it is important to understanding c- and m- direction quality itself. To do so, so called in-plane diffraction method can be adapted, because in-plane method directly evaluates crystallinity of c- or m- plane by glancing along surface and which can help separate tilt component from normal rocking curve. Using this approach, growth mechanism of a-plane GaN along lateral direction, or twist and twin structure will be discussed.