

AlGaN Growth Characteristics by HRXRD and Reciprocal Space Mapping

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From the display parts at the early days to today's BLU of TV and the lighting devices, LEDs expand the application area, and to do that it is need to get higher brightness and long-term reliability. Although there are many achievements in packaging techniques, circuit design techniques, it is inevitable to see the limits of the devices without epi characteristics improvements itself. AlGaN is commonly used for LED epi-layers in order to control carrier's injection to active layers and to confine the carriers. But when growing AlGaN thick layer, by tensile stress, there can be cracks in the film. To avoid this problem, SLS typed AlGaN layers could be possible. At depositing the SLS composed of AlGaN and GaN, the temperatures of each layer are different, so if temperature control is not properly conducted, the device's performance can not be guaranteed. Especially AlGaN deposition needs high temperature and high Al flux, but at the same time, GaN layer must endure the thermal stress during heating and cooling cycles. The reason why AlGaN layer should be deposited at the high temperature is that TMAI decomposition rate at lower temperature is not easily controlled. So it is important to set the safe condition for AlGaN layer's growth to avoid large thermal stress on the entire device layers. In this presentation, AlGaN single layers which were deposited at different conditions will be analyzed and discussed in point of view of crystal, morphological and optical properties. Using HRXRD, many interesting phenomena such as cracks, deformations during deposition will be discussed, and especially to analyze further crystal properties along in-plane, out of plane direction and relaxation characteristics, RSM can be a promising analytical tool. Through this approach, it will be possible to analyze lateral coherency and mosaic spreading characteristics, and these factors will be able to say the phenomena of TMAI decomposition, Al incorporation into the film and morphological relationships.

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