

演講題目

Development of InGaN-based Nonpolar and Semipolar Green Laser Diode (LD) in UCSB

Nonpolar and semipolar planes on wurtzite nitrides have attracted much attention due to their eliminated and reduced polarization-related electric field in the quantum wells (QWs). Violet and blue nonpolar m-plane laser diodes (LDs) have been demonstrated under continuous wave operation. However, the operation in green spectral region has been limited due to low In incorporation and the formation of basal plane stacking faults on m-plane. With decent In incorporation on semipolar planes, high performance green light-emitting diodes (LEDs) and LDs have been demonstrated on (20 $\bar{2}1$) plane. On the other hand, low efficiency droop and high optical polarization ratio were also observed on semipolar (20 $\bar{2}1$) LEDs.

The polarity has strong impacts on the growth characteristics and device performance on semipolar planes. The piezoelectric polarizations of InGaN QWs on the (20 $\bar{2}1$) plane are parallel to those on the Ga-polar plane with a quarter magnitude. Polarization-related electric fields in the (20 $\bar{2}1$) QWs cancel the built-in electric fields in the p-n junction, resulting in a nearly-flat QW potential profile under zero bias. According to the band diagram simulations, the potential profile of (20 $\bar{2}1$) QWs is insensitive to the applied bias and current injection. Along with high compositional homogeneity in the QWs, the semipolar (20 $\bar{2}1$) LEDs and LDs showed minimal wavelength blueshift over three orders of injection current levels. With proper control of growth condition and epi structure design, semipolar (20 $\bar{2}1$) laser diodes with lasing wavelength up to 505 nm were demonstrated with 4 nm blueshift between the spontaneous emission and lasing.

演講者

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Dr. Chia-Yen Huang is born in Taipei, 1985. He received his bachelor degree from the department of Materials and Engineering in National Taiwan University in 2007. In his graduate career in University of California, Santa Barbara, his research included the structure design and epitaxial growth nitride-based green laser diodes. He is also interested in fundamental EL characteristics of non-polar and semipolar LEDs. He received Ph.D. degree in materials in 2012. Currently he served as principle engineer of epitaxial technology in Epistar for high-efficacy LED for general illumination



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