

PROCEEDINGS OF SPIE

# ***Gallium Nitride Materials and Devices VI***

**Jen-Inn Chyi  
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*Editors*

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## Introduction

GaN based electronic and optoelectronic devices continue to develop rapidly as reflected by the advances reported at the meeting. Today, the GaN based light emitters adorn the automobiles, traffic lights, moving signs, outdoor displays, handheld electronics, and background lighting in many consumer electronics including flat panel televisions. All LED outdoor lighting applications are already in full swing. Indoor lighting with LEDs seems to be catching up as high efficiency warm-white lamps, some voltage compatible with existing fixtures, have been demonstrated by increasing number of vendors. Efficiency retention or the loss of it at high injection levels has received a great deal of attention due to the enormous impact of efficiency on indoor lighting by LEDs. To the end, non polar and semi-polar orientations of GaN and InGaN in the context of growth and investigations of optical processes are under intensive studies. Models accounting for leakage, including that due hot electrons, and remedies therefore are being developed. Due to cost pressures, using Si substrates for GaN epitaxy with clever patterning and strain balancing, to avoid cracking upon cooling from growth temperatures, is being implemented. Semi-polar LEDs on Si substrates have also been demonstrated. New LED approaches, such as alternating-current (AC) LEDs and high-voltage (HV) LEDs, have shown their potential in addressing the cost and reliability issues.

The research on GaN-based power electronic devices, including FETs and diodes, has drawn increasing attentions lately, especially from the industry sector as the deployments of energy efficient power supplies and converter for all electric and hybrid vehicles are highly sought after. To compete with its Si counterpart in this realm, novel device structures and process technologies for GaN-based devices are emerging. High-breakdown normally-off devices with low on-resistance, low off-leakage current, fast recovery time, high temperature operation, and high conversion efficiency are rigorously pursued. Monolithic integration of GaN power transistors and Schottky diodes for inverters have been demonstrated.

The SPIE symposium on GaN Materials and Devices is annually organized to disseminate the latest results and provide an opportunity for researchers from around the world to engage in far reaching and probing discussions. Many world renowned invited speakers from Asia, Europe and USA set the stage with wide ranging formal discussions. Not to be underestimated is the fact that the meeting served the purpose of getting experts and newcomers, particularly graduate students who turned out in large numbers, together for friendship and informal discussions of issues relevant to GaN and related materials and devices, and also to develop collaborations. Such exchanges will undoubtedly play an invaluable role in propelling the field forward in general and in particular addressing pivotal issues such as determination and improvement of internal quantum efficiency

and external quantum efficiency of LEDs as well as realizing the full potential of GaN power devices for energy efficiency products.

**Jen-Inn Chyi**  
**Hadis Morkoç**  
**Yasushi Nanishi**  
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