Front Matter: Volume 8123
Eleventh International Conference on Solid State Lighting

Matthew H. Kane
Christian Wetzel
Jian-Jang Huang
Editors

22–24 August 2011
San Diego, California, United States

Sponsored and Published by
SPIE
Contents

ix Conference Committee

OLEDs AND SOLID STATE LIGHTING PLENARY SESSION

8123 02 Is solid state lighting ready for the incandescent lamp phase-out? [8123-102]
N. Narendran, Rensselaer Polytechnic Institute (United States)

SOLID STATE LIGHTING APPLICATIONS

8123 03 Optical design and lighting application of an LED-based sports lighting system (Invited Paper) [8123-01]
L. Boxler, Musco Sports Lighting, LLC (United States)

8123 04 Design, simulation, and measurement of LED reading lamp with non-axisymmetrical reflector and freeform lens [8123-02]
W.-Y. Chao, Y.-Y. Chen, A. J.-W. Whang, M.-J. Lu, National Taiwan Univ. of Science and Technology (Taiwan)

8123 05 Investigation of tunable LED lighting for general illumination employing preliminary activity recognition sensor network [8123-03]
M. Thompson, J. Spaulding, OSRAM SYLVANIA Inc. (United States); K. Larson, H. Hall, Massachusetts Institute of Technology (United States)

8123 06 Optical system design for a reflector-based LED food lighting module [8123-05]
A. Bäuerle, RWTH Aachen (Germany) and Fraunhofer Institute for Laser Technology (Germany); C. Schnitzler, RWTH Aachen (Germany); R. Wester, Fraunhofer Institute for Laser Technology (Germany); M. Kirsten, Bäro GmbH & Co. KG (Germany); H. Schlüter, M. Tewes, Alux-Luxar GmbH & Co. KG (Germany); H. Laschefski, Alanod Aluminium-Veredlung GmbH & Co. KG (Germany); P. Loosen, RWTH Aachen (Germany) and Fraunhofer Institute for Laser Technology (Germany)

8123 07 Non-axisymmetrical freeform design for short LED street lamp [8123-06]
C.-H. Jen, Y.-Y. Chen, A. J.-W. Whang, M.-J. Lu, National Taiwan Univ. of Science and Technology (Taiwan)

III-NITRIDE MATERIALS AND DEVICES I

8123 08 Phosphor-free white: the prospects for green direct emitters (Invited Paper) [8123-07]
C. Wetzel, T. Detchprohm, Rensselaer Polytechnic Institute (United States)
Material properties of MOCVD-grown AlGaN layers influenced by indium-incorporation [8123-08]
T.-Y. Lin, National Taiwan Univ. (Taiwan); L. Li, Peking Univ. (Taiwan); C. Chen, Sun Yat-Sen Univ. (China); Y.-L. Chung, National Taiwan Univ. (Taiwan); S. D. Yao, Peking Univ. (China); Y.-C. Lee, Tungnan Univ. (Taiwan); Z. R. Qiu, Sun Yat-Sen Univ. (China); I. T. Ferguson, The Univ. of North Carolina at Charlotte (United States); D.-S. Wuu, National Chung Hsing Univ. (Taiwan) and Daye Univ. (Taiwan); Z. C. Feng, National Taiwan Univ. (Taiwan)

Highly efficient InGaN/GaN blue LEDs on large diameter Si (111) substrates comparable to those on sapphire [8123-09]
J.-Y. Kim, Y. Tak, H.-G. Hong, S. Chae, J. W. Lee, H. Choi, J. K. Kim, B. Min, Y. Park, U.-I. Chung, Samsung Advanced Institute of Technology (Korea, Republic of); M. Kim, S. Lee, N. Cha, Y. Shin, C. Sone, Samsung LED Co., Ltd. (Korea, Republic of); J.-R. Kim, Sejong Univ. (Korea, Republic of); J.-I. Shim, Hanyang Univ. (Korea, Republic of)

Structural and optical properties of InGaN/GaN multiple quantum well light emitting diodes grown on (1122) facet GaN/sapphire templates by metalorganic chemical vapor deposition [8123-11]
J.-L. Huang, National Taiwan Univ. (Taiwan); L. S. Wang, Huazhong Univ. of Science and Technology (China); Y.-S. Lai, National Taiwan Univ. (Taiwan); Y.-C. Lee, Tungnan Univ. (Taiwan); Z. R. Qiu, Sun Yat-Sen Univ. (China); S. Liu, Huazhong Univ. of Science and Technology (China); D.-S. Wuu, National Chung Hsing Univ. (Taiwan); Z. C. Feng, National Taiwan Univ. (Taiwan)

OLEDs AND SOLID STATE LIGHTING: JOINT SESSION WITH CONFERENCE 8115

From dark to bright: novel daylighting applications in solid state lighting (Invited Paper) [8123-13]
H. G. Adler, OSRAM SYLVANIA Inc. (United States)

LIFETIME ISSUES FOR SOLID STATE LIGHTING

Lumen degradation and chromaticity shift in glass and silicone based high-power phosphor-converted white-emitting diodes under thermal tests (Invited Paper) [8123-14]
W.-H. Cheng, National Sun Yat-Sen Univ. (Taiwan); C.-C. Tsai, Far East Univ. (Taiwan); J. Wang, National Sun Yat-Sen Univ. (Taiwan)

Optical performances degradation of InGaN/GaN MQW LEDs related to fluorescence shift of copolymer-based silicone coating [8123-15]
R. Baillot, L. Béchou, C. Belin, T. Buffeteau, I. Pianet, C. Absalon, O. Babot, Y. Deshayes, Y. Ousten, Univ. of Bordeaux (France)

Methods for estimating junction temperature of AC LEDs [8123-60]
A. Jayawardena, Y. Liu, N. Narendran, Rensselaer Polytechnic Institute (United States)
<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>8123 0J</td>
<td>Compact collimators for high-brightness blue LEDs using dielectric multilayers (Invited Paper) [8123-18]</td>
<td>H. J. Cornelissen, Philips Research Europe (Netherlands); H. Ma, C. Ho, M. Li, C. Mu, Delft Univ. of Technology (Netherlands)</td>
</tr>
<tr>
<td>8123 0K</td>
<td>Freeform lens design for LED illumination with high uniformity and efficiency [8123-19]</td>
<td>W.-C. Chen, H. Y. Lin, National Taiwan Univ. (Taiwan)</td>
</tr>
<tr>
<td>8123 0M</td>
<td>Using Taguchi method to design LED lamp for zonal lumen density requirement of ENERGY STAR [8123-21]</td>
<td>J.-L. Yu, Y.-Y. Chen, A. J.-W. Whang, C.-T. Ma, National Taiwan Univ. of Science and Technology (Taiwan)</td>
</tr>
<tr>
<td>8123 0N</td>
<td>Profiling the optical distribution of a white organic light emitting diode as a lighting source [8123-22]</td>
<td>H. Yang, National Taipei Univ. of Technology (Taiwan); J.-C. Su, National Taiwan Univ. of Science and Technology (Taiwan); L.-C. Chen, Y.-C. Lien, National Taipei Univ. of Technology (Taiwan); S.-Y. Peng, National Taiwan Univ. of Science and Technology (Taiwan); Y.-D. Chen, National Taipei Univ. of Technology (Taiwan)</td>
</tr>
<tr>
<td>8123 0O</td>
<td>Freeform reflector design for LED street lighting [8123-23]</td>
<td>C. Li, P. Schreiber, Fraunhofer Institute for Applied Optics and Precision Engineering (Germany); A. Walkling, C. Schierz, Technical Univ. of Ilmenau (Germany); M. Schwede, V. Gühne, JENOPTIK Polymer Systems GmbH (Germany)</td>
</tr>
</tbody>
</table>

**III-NITRIDE MATERIALS AND DEVICES II**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>8123 0R</td>
<td>High-quality vertical light emitting diodes fabrication by mechanical lift-off technique [8123-26]</td>
<td>P.-M. Tu, National Chiao Tung Univ. (Taiwan); S.-C. Hsu, Tamkang Univ. (Taiwan); C.-Y. Chang, National Chiao Tung Univ. (Taiwan)</td>
</tr>
<tr>
<td>8123 0T</td>
<td>Low-temperature electroluminescent behaviors of InGaN/GaN-based nanorod light emitting diode arrays [8123-28]</td>
<td>L.-Y. Chen, C.-H. Chang, Y.-Y. Huang, J. Huang, National Taiwan Univ. (Taiwan)</td>
</tr>
</tbody>
</table>

**STANDARDS**

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>8123 0V</td>
<td>Methods for measuring work surface illuminance in adaptive solid state lighting networks [8123-30]</td>
<td>B. Lee, M. Aldrich, J. A. Paradiso, Massachusetts Institute of Technology (United States)</td>
</tr>
<tr>
<td>8123 0W</td>
<td>Addressing the variables in LED product design to ensure product reliability [8123-31]</td>
<td>P. F. Keebler, F. D. Sharp, Electric Power Research Institute, Inc. (United States)</td>
</tr>
<tr>
<td>8123 0X</td>
<td>Statistical approach to color rendition properties of solid state light sources [8123-32]</td>
<td>A. Žukauskas, R. Vaicekauskas, A. Tuzikas, P. Vitta, Vilnius Univ. (Lithuania); M. Shur, Rensselaer Polytechnic Institute (United States)</td>
</tr>
</tbody>
</table>
THERMAL MANAGEMENT ISSUES FOR SOLID STATE LIGHTING

8123 10 Evaluating the junction temperature of AC LEDs by DC and AC methods [8123-35]
H.-K. Fu, K.-Y. Tai, C.-P. Wang, P.-T. Chou, Industrial Technology Research Institute (Taiwan)

NOVEL MATERIALS FOR SOLID STATE LIGHTING

8123 14 Structural and optical properties of a-plane GaN on r-plane sapphire with titanium oxide nanoparticles coated by spin coating method [8123-39]
J. H. Kim, Korea Univ. (Korea, Republic of) and Korea Electronics Technology Institute (Korea, Republic of); J. H. Park, Korea Univ. (Korea, Republic of); K. H. Baik, S.-M. Hwang, Korea Electronics Technology Institute (Korea, Republic of)

8123 16 Intense blue-white luminescence from amorphous silicon oxycarbide (a-SiC\textsubscript{x}O\textsubscript{y}) thin films [8123-41]
V. Nikas, S. Gallis, H. Suhag, M. Huang, A. E. Kaloyeros, Univ. at Albany (United States)

POSTER SESSION

8123 18 Effects of voltage modulation of individual RGYB LEDs on the high power phosphor LED for color temperature and luminous efficiency [8123-42]
H.-C. Chen, G.-Y. Wu, C.-H. Yang, Y.-M. Lo, J.-F. Jhou, S.-R. Li, National Yunlin Univ. of Science and Technology (Taiwan)

8123 1A Light extraction improvement of GaN LEDs using nano-scale top transmission gratings [8123-44]
G. Chavoor, X. Jin, A. Ellaboudy, California Polytechnic State Univ., San Luis Obispo (United States); X.-X. Fu, X.-N. Kang, B. Zhang, G.-Y. Zhang, Peking Univ. (China)

8123 1D Efficiency droop improvement in GaN-based light emitting diodes by graded-composition electron blocking layer [8123-47]

8123 1F Optical and electrical properties of GaN-based light emitting diodes grown on micro- and nano-scale patterned Si substrate [8123-49]
C.-H. Chiu, C.-C. Lin, National Chiao Tung Univ. (Taiwan); D. Deng, Hong Kong Univ. of Science and Technology (Hong Kong, China); H.-C. Kuo, National Chiao Tung Univ. (Taiwan); K.-M. Lau, Hong Kong Univ. of Science and Technology (Hong Kong, China)

8123 1H Energy-saving approaches to solid state street lighting [8123-51]
P. Viita, R. Stanikūnas, A. Tuzikas, I. Reklaitis, A. Stonkus, A. Petrulis, H. Vaitkevičius, A. Žukauskas, Vilnius Univ. (Lithuania)
8123 II LEDs on curved ceramic substrate with primary optics for modification of luminous intensity [8123-52]  
A.-C. Wei, Power Lens Technology Inc. (Taiwan) and Foxsemicon Integration Technology Inc. (Taiwan); J.-R. Sze, Instrument Technology Research Ctr. (Taiwan); J.-L. Chern, Power Lens Technology Inc. (Taiwan) and Foxsemicon Integration Technology Inc. (Taiwan) and National Chiao Tung Univ. (Taiwan)  

8123 1J Effects of pitch and shape for diffraction grating in LED fog lamp [8123-53]  
H.-C. Chen, J.-Y. Lin, National Yunlin Univ. of Science and Technology (Taiwan); J.-H. Wu, Ming Chuan Univ. (Taiwan); S.-H. Ma, Feng Chia Univ. (Taiwan); C.-H. Yang, National Yunlin Univ. of Science and Technology (Taiwan)  

8123 1L Atomic distribution of transition metals in III-nitrides [8123-55]  
R. W. Nicholas, M. H. Kane, The Univ. of Oklahoma (United States)  

8123 1N Self-assembled microlens on light emitting diodes using hydrophilic effect [8123-57]  
H.-C. Wei, G.-D. J. Su, National Taiwan Univ. (Taiwan)  

8123 1P Optimal design of light distribution of LED luminaries for road lighting [8123-59]  
W. Lai, W. Chen, X. Liu, X. Lei, Chongqing Univ. (China)  

Author Index
Conference Committee

Program Track Chair

Ian T. Ferguson, The University of North Carolina at Charlotte (United States)

Conference Chairs

Matthew H. Kane, Massachusetts Maritime Academy (United States)
Christian Wetzel, Rensselaer Polytechnic Institute (United States)
Jian-Jang Huang, National Taiwan University (Taiwan)

Founding Chair

Ian T. Ferguson, The University of North Carolina at Charlotte (United States)

Program Committee

Srinath K. Aanegola, GE Global Research (India)
Andrew A. Allerman, Sandia National Laboratories (United States)
Ian E. Ashdown, byHeart Consultants Ltd. (Canada)
Lianghui Chen, Institute of Semiconductors (China)
John W. Curran, LED Transformations, LLC (United States)
Nikolaus Dietz, Georgia State University (United States)
Samuel Graham, Georgia Institute of Technology (United States)
Volker K. Härle, OSRAM Opto Semiconductors GmbH (Germany)
Christoph Hoelen, Philips Lighting B.V. (Netherlands)
Jianzhong Jiao, OSRAM Opto Semiconductors Inc. (United States)
Asif M. Khan, University of South Carolina (United States)
Michael R. Krames, Soraq, Inc. (United States)
Y. S. Liu, National Tsing Hua University (Taiwan)
Nadarajah Narendran, Rensselaer Polytechnic Institute (United States)
Eun-Hyun Park, Kyung Hee University (Korea, Republic of)
Seong-Ju Park, Gwangju Institute of Science and Technology (Korea, Republic of)
Jeff Quinlan, Acuity Brands Lighting, Inc. (United States)
Robert V. Steele, Strategies Unlimited (United States)
Chih-Chung Yang, National Taiwan University (Taiwan)
Session Chairs

OLEDs and Solid State Lighting Plenary Session

Franky So, University of Florida (United States)
Ian T. Ferguson, The University of North Carolina at Charlotte (United States)

1 Solid State Lighting Applications
Matthew H. Kane, Massachusetts Maritime Academy (United States)

2 III-nitride Materials and Devices I
Jianzhong Jiao, OSRAM Opto Semiconductors Inc. (United States)

3 OLEDs and Solid State Lighting: Joint Session with Conference 8115
Seong-Ju Park, Gwangju Institute of Science and Technology (Korea, Republic of)
Neetu Chopra, Plextronics Inc. (United States)

4 Lifetime Issues for Solid State Lighting
Nadarajah Narendran, Rensselaer Polytechnic Institute (United States)

5 Light Extraction Strategies and Optical Modeling
Ching-Cherng Sun, National Central University (Taiwan)

6 III-nitride Materials and Devices II
Christian Wetzel, Rensselaer Polytechnic Institute (United States)

7 Standards
Nikolaus Dietz, Georgia State University (United States)

8 Thermal Management Issues for Solid State Lighting
Wood Hi Cheng, National Sun Yat-Sen University (Taiwan)

9 Novel Materials for Solid State Lighting
Jian-Jang Huang, National Taiwan University (Taiwan)