# Yuji Zhao

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## RESEARCH SUMMARY

**Research Interests**
**GaN-based materials and devices including LEDs, lasers, solar cells, and power transistors.**

- At UCSB, Dr. Yuji Zhao was on the R&D team with Nobel Laurate Shuji Nakamura that developed world's best performance high efficiency semipolar LEDs and green laser diode. These devices are 10 times smaller, yet 10 times brighter, at up to 5 times of the current densities, than the conventional LEDs.
- At ASU, Dr. Yuji Zhao is leading a research team of over 10 students and postdocs focus on GaN LEDs, solar cells, and power transistors, with funding support from DOE, DoD, NASA, and SFAz, etc.

**Selective Media Highlights of Dr. Yuji Zhao: over 100 media reports with over 6 languages**

- **Arizona PBS will feature a scientific TV documentary on Yuji Zhao and GaN Space Technology in 2018**
- *ASU engineer showcases NASA research to congress on capitol hill*, ASU news, Jan 2018
- *Gallium nitride processor: next-generation technology for space exploration*, **Astrowatch, Phys.org, Spaceflightinsider, ECNMag, Technewsngadgets, ASU news, etc., English and Chinese, Dec 2017**
- *Vertical gallium nitride Schottky diodes with single and double drift layers*, Semiconductor Today, Oct 2017
- *Aluminum nitride Schottky barrier diodes with breakdown more than 1kV*, Silicon Valley Microelectronics, August 2017
- *Indium gallium nitride solar cells on non-polar and semi-polar substrates*, Semiconductor Today, May 2017
- *Buffer and drift layer effects on vertical gallium nitride diodes*, Semiconductor Today, Apr 2017
- *Thermophotonics: LEDs feed on waste heat*, **Nature Photonics**, Nov 2015
- *Overcoming the "green gap"*, **Nature Photonics**, Jul 2013
- *Semipolar planes delivers stable green LEDs*, Compound Semiconductor, Aug 2013
- *How LED got their shine back*, **Science**, May 2012
- *Conquering LED efficiency droop*, Optical Society of America (OSA), April 2012
- *New LED design drops the droop*, Photonics, May 2012
- *LEDs más eficientes para el hogar*, Sustentator, Spanish, May 2012
- *Special substrates help LEDs shine brighter without losing efficiency*, Daily Tech, May 2012
- *Reducing LED droop at high current*, Semiconductor Today, Jul 2011
- *Blue semipolar LEDs now comparable to conventional c-plane devices*, Laser Focus World, Nov 2010
- *UCSB achieves semi-polar light extraction comparable to conventional LEDs*, Semiconductor Today, Sep 2010

## EDUCATION

| | | |
|---|---|---|
| University of California, Santa Barbara | Ph.D. in Electrical and Computer Engineering | 2008–2012 |
| **Advisor: Prof. Shuji Nakamura (Nobel Prize in Physics 2014)** | | |
| Fudan University | B.S. in Microelectronics | 2004–2008 |

## APPOINTMENTS

**Arizona State University**

- Assistant Professor — Electrical, Computer and Energy Engineering — 08/2014–Present
- Established ASU GaN MOCVD facilities through startup funding, extramural funding, and equipment donations

**University of California, Santa Barbara**

- Assistant Project Scientist — Materials Department and SSLEC — 01/2013–08/2014
- Graduate Student Researcher — Electrical and Computer Engineering — 09/2008–12/2012

## SELECTIVE AWARDS AND HONORS

2017 Selected as Honorable NASA Faculty Scientist to Showcase Space Technology to Congress at Capitol Hill presented to U.S. Representative Lamar Smith, chairman of the Committee on Science, Space, and Technology
2017 ASU Fulton Outstanding Assistant Professor Award
2016 DoD DTRA Young Investigator Program (YIP) Award
2015 NASA Early Career Faculty (ECF) Award
2015 Bisgrove Scholar Tenure Track Faculty Award
2013 UCSB SSLEC Outstanding Postdoctoral Research Achievement Award
2012 Applied Physics Letters Editor's Picks of the Year Award
2012 Applied Physics Express Most Cited Article of the Year Award
2012 Semi-Finalist, CLEO Theodore Maiman Student Paper Competition (ranked 1st in Energy and Environment session)
2012 UCSB SSLEC Outstanding Graduate Student Research Achievement Award
2011 UCSB SSLEC Outstanding Graduate Student Research Achievement Award
2010 UCSB SSLEC Outstanding Graduate Student Research Achievement Award
2004 Fudan University Scholarship for Excellency in Undergraduate Study

## SEMINARS AND INVITED TALKS

1. **2018 ECS and SMEQ Joint International Meeting (AiMES 2018)**, Cancun, Mexico, Sep 2018
2. **2018 Government Microcircuit Applications and Critical Technology Conference (GOMACTech 2018)**, Miami, FL, Mar 2018
3. **2018 Workshop on Compound Semiconductor Materials and Devices (WOCSEMMAD 2018)**, San Diego, CA, Feb 2018
4. **Stanford University**, Department of Electrical Engineering, Palo Alto, CA, Nov 2017
5. **University of California, Los Angeles**, Department of Electrical and Computer Engineering, Los Angeles, CA, Nov 2017
6. **NASA Glenn Research Center**, Cleveland, OH, Nov 2017
7. **Arizona State University,** ASU Nanoscience Seminar, Tempe, AZ, Oct 2017
8. **University of Southern California**, Distinguished Lectures, Department of Chemical Engineering and Materials Science, Los Angeles, CA, Oct 2017
9. **University of California, San Diego**, Department of Electrical and Computer Engineering, La Jolla, CA, Oct 2017
10. **The 60th IEEE International Midwest Symposium on Circuits and Systems**, Boston, MA, Aug 2017
11. **2017 IEEE Photonics Society Summer Topicals Meeting**, San Juan, Puerto Rico, Jul 2017
12. **2017 International Symposium on Advanced Lighting Science and Technology (ALST 2017)**, Shaoxing, China, May 2017
13. **The 24th Space Photovoltaic Research and Technology (SPRAT) Conference**, Cleveland, OH, Sep 2016
14. **Fudan University**, School of Information Science and Technology, Shanghai, China, Jul 2015
15. **Suzhou Institute of Nano-Tech and Nano-Bionics,** Suzhou, China, Jul 2015
16. **Massachusetts Institute of Technology**, Department of Electrical Engineering and Computer Science, Cambridge, MA, May 2015
17. **Soitec Phoenix Lab Inc**, Tempe, AZ, Oct 2014
18. **Arizona State University**, School of Electrical, Computer and Energy Engineering, Tempe, AZ, May 2014
19. **University of California, San Diego**, Department of Electrical and Computer Engineering, La Jolla, CA, Apr 2014
20. **University of California, San Diego**, Department of Electrical and Computer Engineering, La Jolla, CA, Aug 2013
21. **University of California, Santa Barbara**, Nitride Special Seminar, Santa Barbara, CA, Nov 2013
22. **University of Notre Dame**, Department of Electrical Engineering, Notre Dame, IN, Jul 2013
23. **University of Virginia**, Charles L. Brown Department of Electrical and Computer Engineering, Charlottesville, VA, Apr 2013

24. **Society of Information Display (SID) 50th Anniversary Conference**, Los Angeles, CA, Sep 2012
25. **Fudan University**, School of information science and Engineering, Shanghai, China, Jun 2012
26. **University of California, Santa Barbara**, Nitride Special Seminar, Santa Barbara, CA, Feb 2012
27. **Tsinghua University**, Tsinghua National Laboratory for Information Science and Technology, Beijing, China, May 2011
28. **Peking University**, State Key Laboratory for Artificial Microstructures and Mesoscopic Physics, Beijing, China, May 2011
29. **Zhejiang University**, Center for Optical and Electromagnetic Research, Hangzhou, China, May 2011
30. **University of California, Santa Barbara**, Nitride Special Seminar, Santa Barbara, CA, Feb 2011

## PUBLICATIONS

**Journal papers (published and accepted)**

1. H. Fu, K. Fu, X. Huang, H. Chen, I. Baranowski, T. H. Yang, J. Montes, and Y. Zhao, "High performance vertical GaN-on-GaN p-n power diodes with hydrogen-plasma based edge termination", *accepted to IEEE Electron Device Lett.*
2. H. Fu, H. Chen, X. Huang, I. Baranowski, J. Montes, T. H. Yang, and Y. Zhao, "Effect of crystalline anisotropy on vertical (-201) and (010) β-$Ga_2O_3$ Schottky barrier diodes on EFG single-crystal substrates", accepted to *IEEE T Electron Dev.*
3. H. Chen. H. Fu, X. Huang, X. Zhang, T. H. Yang, J. A. Montes, I. Baranowski, and Y. Zhao, "Characterizations of the nonlinear optical properties for (010) and (-201) beta-phase gallium oxide", *Opt. Express* **26**, 3938 (2018).
4. Y. Zhao, H. Fu, G. T. Wang, and S. Nakamura, "Toward ultimate efficiency: progress and prospects on nonpolar and semipolar InGaN light emitting diodes", *Adv. Opt. Photonics* **10**, 246 (2018). (review paper)
   **Highlight in ASU News.**
5. X. Huang, H. Fu, H. Chen, Z. Lu, I. Baranowski, J. Montes, T. H. Yang, B. P. Gunning, D. Koleske, and Y. Zhao, "Reliability analysis of InGaN/GaN multi-quantum-well (MQW) solar cells under thermal stress", *Appl. Phys. Lett*. **111**, 233511 (2017).
6. H. Chen, H. Fu, X. Huang, X. Zhang, T. H. Yang, J. A. Montes, I. Baranowski, and Y. Zhao, "Low loss GaN waveguides at the visible spectral wavelengths for integrated photonics applications", *Opt. Express* **25**, 31758 (2017).
7. H. Fu, X. Huang, H. Chen, Z. Lu, I. Baranowski, and Y. Zhao, "Ultra-low turn-on voltage and on-resistance vertical GaN-on-GaN Schottky barrier diodes with high mobility double drift layers", *Appl. Phys. Lett*. **111**, 152102 (2017).
   **Highlight in Compound Semiconductor, Semiconductor Today, etc.**
8. H. Y. Huang, Y. Fan, Z. Lu, T. Luo, H. Fu, H. Song, Y. Zhao, and J. B. Christen, "Variable self-powered light detection CMOS chip with real-time adaptive tracking digital output based on a novel on-chip sensor", *Opt. Express* **25**, 24138 (2017).
9. H. Fu, X. Huang, H. Chen, Z. Lu, and Y. Zhao., "Fabrication and characterization of ultra-wide bandgap AlN based Schottky diodes on sapphire by MOCVD", *IEEE J. Electron Devices Soc*. **5**, 518 (2017).
   **Top 50 most poplular articles in October 2017 and January 2018 in JEDS.**
10. Z. Lu, P. Tian, H. Chen, I. Baranowski, H. Fu, X. Huang, J. Montes, Y. Fan, H. Wang, X. Liu, R. Liu, and Y. Zhao, "Active tracking system for visible light communication using a GaN-based micro-LED and NRZ-OOK", *Opt. Express* **25**, 17971 (2017).
11. H. Fu, X. Zhang, X. Huang, I. Baranowski, H. Chen, Z. Lu, J. Montes, and Y. Zhao, "Demonstration of AlN Schottky barrier diodes with blocking voltage over 1kV", *IEEE Electron Device Lett.* **38**, 1286 (2017).
    **Highlight in Silicon Valley Microelectronics, Semiconductor Today, etc.**
    **Top 50 most popular articles in August and September 2017 in IEEE EDL.**
12. H. Chen, X. Huang, H. Fu, Z. Lu, X. Zhang, J. Montes, and Y. Zhao, "Characterizations of nonlinear optical properties on GaN crystals in polar, nonpolar, and semipolar orientations," *Appl. Phys. Lett*. **110**, 181110 (2017).
13. H. Fu, X. Huang, H. Chen, Z. Lu, X. Zhang, and Y. Zhao, "Effect of buffer layer design on vertical GaN-on-GaN p-n and Schottky power diodes", *IEEE Electron Device Lett.* **38**, 763 (2017).
    **Highlight in Silicon Valley Microelectronics, Semiconductor Today, etc.**
    **Top 50 most popular articles in April, May, and June 2017 in IEEE EDL.**
14. X. Huang, H. Fu, H. Chen, X. Zhang, Z. Lu, J. Montes, M. Iza, S. P. DenBaars, S. Nakamura, and Y. Zhao, "Nonpolar and semipolar InGaN solar cells with improved carrier collection efficiency", *Appl. Phys. Lett*. **110**, 161105 (2017).
    **Highlight in Semiconductor Today.**
15. H. Chen, H. Fu, X. Huang, Z. Lu, X. Zhang, J. Montes, and Y. Zhao, "Optical cavity effects in InGaN core-shell light-emitting diodes with metallic coating", *IEEE Photonics J.* **9**, 8200808 (2017).

16. H. Fu, H. Chen, X. Huang, Z. Lu, and Y. Zhao, "Theoretical analysis of modulation doping effects on intersubband transition properties of semipolar AlGaN/GaN quantum well", *J. Appl. Phys.* **121**, 014501 (2017).
17. H. Fu, Z. Lu, Y. Zhao, "Phase-space filling effect on the modeling of low-droop performance of semipolar InGaN light-emitting diodes", *AIP Adv*. **6**, 065013 (2016).
18. X. Huang, H. Fu, H. Chen, Z. Lu, D. Ding, and Y. Zhao, "Analysis of loss mechanisms in InGaN solar cells using a semi-analytical model", *J. Appl. Phys.* **119**, 213101 (2016).
19. H. Fu, Z. Lu, X. Huang, H. Chen, and Y. Zhao, "Crystal orientation dependent intersubband transition in semipolar AlGaN/GaN single quantum well for optoelectronic applications", *J. Appl. Phys.* **119**, 213101 (2016).
20. H. Fu, Z. Lu, X. Zhao, Y. H. Zhang, S. P. DenBaars, S. Nakamura, and Y. Zhao, "Study of low-efficiency-droop semipolar (20-2-1) InGaN by time-resolved photoluminescence", *J. Display Technol.* **12**, 736 (2016).
21. H. Chen, H. Fu, X. Huang, Z. Lu, and Y. Zhao, "Optical properties of highly polarized InGaN light-emitting diodes modified by metallic grating," *Opt. Express* **24**, A856 (2016).
22. C. C. Pan, Q. Yan, H. Fu, Y. Zhao, Y. R. Wu, C. G. Van de Walle, S. Nakamura, and S. P. DenBaars, "High optical power and low efficiency droop blue light-emitting diodes using compositionally step-graded InGaN barriers", *Electron. Lett.* **51**, 1187 (2015).
23. R. Ivanov, S. Marcinkevicius, Y. Zhao, D. L. Becerra, S. Nakamura, S. P. DenBaars, and J. S. Speck, "Impact of carrier localization on recombination times in semipolar (20-21) plane InGaN/GaN quantum wells", *Appl. Phys. Lett.* **107**, 211109 (2015).
24. J. Xue, Y. Zhao, S. H. Oh, J. S. Speck, S. P. DenBaars, S. Nakamura, and R. J. Ram, "Thermally Enhanced Blue Light-Emitting Diodes", *Appl. Phys. Lett.* **107**, 121109 (2015).
    **Highlight in Nature Photonics, vol. 9, 782 (2015).**
25. K. Gelzinyte, S Marcinkevicius, Y. Zhao, D. L. Becerra, S. Nakamura, S. P. DenBaars, and J. S. Speck, "High spatial uniformity of photoluminescence spectra in semipolar (20-21) plane InGaN/GaN quantum wells", *J. Appl. Phys*. **117**, 023111 (2015).
26. D. L. Becerra, Y. Zhao, S. H. Oh, C. D. Pynn, K. Fujito, S. P. DenBaars, and S. Nakamura, "High-power low-droop violet semipolar (30-3-1) InGaN/GaN light-emitting diodes with thick active layer design", *Appl. Phys. Lett.* **105**, 171106 (2014).
    **Highlight in Semiconductor Today.**
27. Y. Zhao, R. M. Farrell, Y. R. Wu, J. S. Speck, "On the optical polarization ratio and valance band separation for nonpolar and semipolar InGaN quantum well light-emitting devices", *Jpn. J. Appl. Phys.* **53**, 100206 (2014). (Invited)
28. S. Marcinkevicius, K. Gelzinyte, Y. Zhao, S. Nakamura, S. P. DenBaars, and J. S. Speck, "Carrier distributation between different potential cites in semipolar quantum well studied by near-field photoluminecence", *Appl. Phys. Lett.* **105**, 111108 (2014).
29. F. Wu, Y. Zhao, A. E. Romanov, S. P. DenBaars, S. Nakamua, and J. S. Speck, "Stacking faults and interface roughening in semipolar (20-2-1) grown single InGaN quantum wells for long wavelength light emitting diodes", *Appl. Phys. Lett.* **106**, 151901 (2014).
30. Y. Ji, W. Liu, T. Erdem, R. Chen, S. T. Tan, Z. H. Zhang, Z. Ju, X. Zhang, H. Sun, X. W. Sun, Y. Zhao, S. P. DenBaars, S. Nakamura, and H. V. Demir, "Comparative study of field-dependent carrier dynamics and emission kinetics of InGaN/GaN light-emitting diodes grown on (11-22) semipolar versus (0001) polar planes", *Appl. Phys. Lett.* **104**, 143506 (2014).
31. S. Marcinkevicius, R. Ivanov, Y. Zhao, S. Nakamura, S. P. DenBaars, and J. S. Speck, "Highly polarized photoluminescence and its dynamics in semipolar (20-2-1) InGaN/GaN quantum well", *Appl. Phys. Lett.* **104**, 111113 (2014).
32. Y. Zhao, F. Wu, T. J. Yang, Y. R. Wu, S. Nakamura, and J. S. Speck, "Atomic scale nanofacet structure in semipolar InGaN single quantum well", *Appl. Phys. Express* **7**, 025503 (2014).
33. M. T. Hardy, F. Wu, C. Y. Huang, Y. Zhao, D. Feezell, J. S. Speck, S. Nakamura, and S. P. DenBaars, "Impact of p-GaN temperature and AlGaN barrier composition on (20-21) green laser diodes", *IEEE Photonics Technol. Lett.* **26**, 43 (2014).
34. S. Marcinkevicius, Y. Zhao, K. M. Kelchner, S. Nakamura, S. P. DenBaars, and J. S. Speck, "Near-field investigation of spatial variations of (20-2-1) InGaN quantum well emission spectra", *Appl. Phys. Lett.* **102**, 131116 (2013).
35. Y. Zhao, S. H. Oh, F. Wu, Y. Kawaguchi, S. Tanaka, K. Fujito, J. S. Speck, S. P. DenBaars, and S. Nakamura, "Green semipolar (20-2-1) InGaN light-emitting diodes with small wavelength shift and narrow spectral width", *Appl. Phys. Express* **6**, 062102 (2013).
    **Highlight in Nature Photonics, vol. 7, 585 (2013), Compound Semiconductor, etc.**
    **Selected as "Research Highlights" on front page of APEX.**
    **Top 20 most downloaded articles May to July 2013 in APEX.**

36. Y. Kawaguchi, S. C. Huang, R. M. Farrell, Y. Zhao, J .S. Speck, S. P. DenBaars, and S. Nakamura, "Dependence of electron overflow on emission wavelength and crystallographic orientation in single-quantum-well III-nitride light-emitting diodes", *Appl. Phys. Express* **6**, 052103 (2013).
**Selected as "Research Spotlights" in APEX.**
**Top 20 most downloaded articles April and June 2013 in APEX.**
37. Y. Zhao, F. Wu, C. Y. Huang, Y. Kawaguchi, S. Tanaka, K. Fujito, J. S. Speck, S. P. DenBaars, and S. Nakamura, "Suppressing the void defects in the long wavelength semipolar InGaN quantum wells by growth rate optimization", *Appl. Phys. Lett.* **102**, 091905 (2013).
38. S. P. DenBaars, D. Feezell, K. Kelchner, S. Pimputkar, C. C. Pan, C. C. Yen, S. Tanaka, Y. Zhao, N. Pfaff, R. Farrell, M. Iza, S. Keller, U. Mishra, J. S. Speck, and S. Nakamura, "Development of gallium-nitride-based light-emitting diodes (LEDs) and laser diodes for energy efficient lighting and displays", *Acta Mater.* **61**, 945 (2013). (Invited)
39. Y. Zhao, Q. Yan, D. Feezell, K. Fujito, C. G. Van de Walle, J. S. Speck, S. P. DenBaars, and S. Nakamura, "Optical polarization characteristics of semipolar (30-31) and (30-3-1) InGaN/GaN light-emitting diodes", *Opt. Express* **21**, A53 (2013).
40. Y. Kawaguchi, C. Y. Huang, Y. R. Wu, Y. Zhao, S. P. DenBaars, and S. Nakamura, "Semipolar single-quantum-well red light-emitting diodes with a low forward voltage", *Jpn. J. Appl. Phys.* **52**, 08JC08 (2013).
41. C. C. Pan, T. Gilberto, N. Pfaff, S. Tanaka, Y. Zhao, D. Feezell, J. S. Speck, S. Nakamura, and S. P. DenBaars, "Reduction in thermal droop using thick quantum well structure in semipolar (20-2-1) blue light-emitting diodes", *Appl. Phys. Express* **5**, 102103 (2012).
**Selected as "Research Highlights" on front page of APEX.**
**Top 20 most downloaded articles September and October 2012 in APEX.**
42. Y. Kawaguchi, C. Y. Huang, Y. R. Wu, Q. Yen, C. C. Pan, Y. Zhao, S. Tanaka, K. Fujito, D. Feezell, C. G. Van de Walle, S. P. DenBaars, and S. Nakamura, "Influence of polarity on carrier transport in semipolar (20-2-1) and (20-21) multiple-quantum-well light-emitting diodes", *Appl. Phys. Lett.* **100**, 231110 (2012).
**Selected as "Editor's Picks of the Year" in 2012 in APL.**
**Selected as "Research Highlights" of AIP June 2012.**
**Selected as "Editor's Choice" in the AIP Virtual Journal of Nanoscience and Technology, Vol. 25(25), June 2012.**
**Top 20 most downloaded articles June 2012 in APL.**
43. C. C. Pan, S. Tanaka, F. Wu, Y. Zhao, J. S. Speck, S. Nakamura, S. P. DenBaars, and D. Feezell, "High-power, low-efficiency-droop (20-2-1) single-quantum-well blue light-emitting diodes", *Appl. Phys. Express* **5**, 062103 (2012).
**Top 20 most downloaded articles June and July 2012 in APEX.**
44. Y. Zhao, Q. Yan, C. Y. Huang, S. C. Huang, P. S. Hsu, S. Tanaka, C. C. Pan, Y. Kawaguchi, K. Fujito, C. G. Van de Walle, J. S. Speck, S. P. DenBaars, S. Nakamura, and D. Feezell, "Indium incorporation and emission properties of nonpolar and semipolar InGaN quantum wells", *Appl. Phys. Lett.* **100**, 201108 (2012).
45. J. J. Richardson, I. Koslow, C. C. Pan, Y. Zhao, J. S. Ha, and S. DenBaars, "Semipolar single-crystal ZnO films deposited by low-temperature aqueous solution phase epitaxy on GaN light-emitting diodes", *Appl. Phys. Express* **4**, 126502 (2011).
**Top 20 most downloaded articles December 2011 in APEX.**
46. C. Y. Huang, Q. Yan, Y. Zhao, D. Feezell, K. Fujito, C. G. Van de Walle, J. S. Speck, S. P. DenBaars, and S. Nakamura, "Influence of Mg-doped barriers on semipolar multi-quantum-well light-emitting diodes", *Appl. Phys. Lett.* **99**, 141114 (2011).
47. Y. Zhao, S. Tanaka, Q. Yan, C. Y. Huang, R. B. Chung, C. C. Pan, K. Fujito, D. Feezell, C. G. Van de Walle, J. S. Speck, S. P. DenBaars, and S. Nakamura, "High optical polarization ratio from semipolar (20-2-1) blue-green InGaN/GaN light-emitting diodes", *Appl. Phys. Lett.* **99**, 051109 (2011).
48. Y. Zhao, S. Tanaka, C. C. Pan, K. Fujito, D. Feezell, J. S. Speck, S. P. DenBaars, and S. Nakamura, "High-power blue-violet semipolar (20-2-1) InGaN/GaN light-emitting diodes with low efficiency droop at 200 A/cm$^2$", *Appl. Phys. Express* **4**, 082104 (2011).
**Highlight in Science, Optical Society of America, Semiconductor Today, etc.**
**Selected as "Most Cited APEX Articles of the Year" in 2012 in APEX.**
**Top 20 most downloaded articles July 2011 in APEX.**
49. S. Tanaka, Y. Zhao, I. Koslow, C. C. Pan, H. T. Chen, J. Sonoda, S. P. DenBaars, and S. Nakamura, "Droop improvement in high current range on PSS-LEDs", *Electron. Lett.* **47**, 335 (2011).
50. S. Yamamoto, Y. Zhao, C. C. Pan, R. B. Chung, K. Fujito, J. Sonoda, S. P. DenBaars, and S. Nakamura, "High-efficiency single-quantum-well green and yellow-green light-emitting diodes on semipolar (20-21) GaN substrates", *Appl. Phys. Express* **3**, 122102 (2010).
**Top 20 most downloaded articles November and December 2010 in APEX.**

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