

SHUJI NAKAMURA, PH.D.
Professor of Materials Department
University of California, Santa Barbara
Santa Barbara, CA 93106-5050

EDUCATION

- 1994 University of Tokushima, Japan
Doctor of Engineering
- 1979 University of Tokushima, Japan
Master of Electronic Engineering
- 1977 University of Tokushima, Japan
Bachelor of Electronic Engineering

ACADEMIC APPOINTMENTS

- 1999 – Present University of California, Santa Barbara
Professor, Materials Department
- 1993 – 1999 Nichia Chemical Ind., Ltd.
Senior Researcher, Department of Research and Development (R&D)
- 1989 – 1993 Nichia Chemical Ind., Ltd.
Group Head, Research and Development 2nd Section
- 1988 – 1989 University of Florida
Visiting Research Associate, Electronic Engineering
- 1985 – 1988 Nichia Chemical Ind., Ltd.
Group Head, Research and Development 1st Section
- 1979 – 1984 Nichia Chemical Ind., Ltd.
Research and Development

HONORS & AWARDS

- 1994, 1996 Nikkei BP Engineering Award
- 1994, 1997 Best Paper Award of Japanese Applied Physics Society
- 1995 Sakurai Award
- 1996 Nishina Memorial Award
- 1996 IEEE Lasers and Electro-Optics Society Engineering Achievement Award
- 1996 Society for Information Display (SID) Special Recognition Award
- 1997 Okochi Memorial Award
- 1997 Materials Research Society (MRS) Medal Award
- 1998 Innovation in Real Materials (IRM) Award
- 1998 C&C Award
- 1998 IEEE Jack A. Morton Award
- 1998 British Rank Prize
- 1999 Julius-Springer Prize for Applied Physics
- 2000 Takayanagi Award
- 2000 Carl Zeiss Research Award

HONORS & AWARDS (Continued)

2000	Honda Award
2000	Crystal Growth and Crystal Technology Award
2001	Asahi Award
2001	Cree Professor in Solid State Lighting and Display Endowed Chair
2001	OSA Nick Holonyak Award
2001	LEOS Distinguished Lecturer Award
2002	IEEE/LEOS Quantum Electronics Award
2002	Recipient of the Franklin Institute's 2002 Benjamin Franklin Medal in Engineering
2002	Takeda Award
2002	The Economist Innovation Award 2002 "No Boundaries"
2002	World Technology Award
2003	CompoundSemi Pioneer Award
2003	National Academy of Engineering Member
2003	Blue Spectrum Pioneer Awards
2004	The Society for Information Display Karl Ferdinand Braun Prize
2006	Global Innovation Leader Award, Optical Media Global Industry Awards
2006	Millennium Technology Prize
2007	Santa Barbara Region Chamber of Commerce Innovator of the Year Award
2007	Czochralski Award
2008	Japanese Science of Applied Physics (JSAP) Outstanding Paper Award for the "Demonstration of Nonpolar m-Plane InGaN/GaN Laser Diode"
2008	The Prince of Asturias Award for Technical Scientific Research (The Prince of Asturias Foundation)
2009	Harvey Prize

PROFESSIONAL ACTIVITIES

1995	Developed the first group-III nitride-based blue/green LEDs
1995	Developed the first group-III nitride-based violet laser diodes (LDs)
1998 – 2000	Editorial Board, Applied Physics Society
2000 – Present	Director, Solid State Lighting and Display Center
2000 – Present	Editorial Board, Compound Semiconductor Magazine
2001 – Present	Editor, Materials Research Society Conference Proceedings
2001 – Present	Director, Exploratory Research for Advanced Technology (ERATO)
2004 – Present	Honorary Professor, Universität Bremen (Germany)
2004 – Present	Guest Professor, Shinshu University (Japan)
2004 – Present	Guest Professor, Tottori University (Japan)
2004 – Present	Guest Professor, University of Tokushima (Japan)
2005 – Present	Honorary Professor, Wuhan University (China)
2007 – Present	Visiting Honorary Professor, Hong Kong University of Science & Technology
2007 – Present	Guest Professor, University of Ehime (Japan)
2009 – Present	Advisor, Shanghai Research Center of Engineering and Technology for Solid-State Lighting (China)
2009 – Present	Advisory Professor, Fudan University (China)

PUBLICATIONS 437 as of 10/28/10

1. S. Nakamura, S. Sakai, S.S. Chang, R.V. Ramaswamy, J.-H. Kim, G. Radhakrishnan, J.K. Liu, J. Katz, *Transient-mode liquid phase epitaxial growth of GaAs on GaAs-coated Si substrates prepared by migration-enhanced molecular beam epitaxy*, J. Cryst. Growth, **Vol. 97**, pp. 303-309. (1989)

2. S. Nakamura, H. Takagi, *High-power and high-efficiency P-GaAlAs/N-GaAs: Si single heterostructure infrared emitting diodes*, Jpn. J. Appl. Phys., **Vol. 29** No. 12, pp. 2694-2697. (1990)
3. S. Nakamura, Y. Harada, M. Senoh, *Novel metalorganic chemical vapor deposition system for GaN growth*, Appl. Phys. Lett., **Vol. 58** No. 18, pp. 2021-2023 (1991)
4. S. Nakamura, *Analysis of real-time monitoring using interference effects*, Jpn. J. Appl. Phys., **Vol. 30** No. 7, pp.1348-1353 (1991)
5. S. Nakamura, *In situ monitoring of GaN growth using interference effects*, Jpn. J. Appl. Phys., **Vol. 30** No. 8, pp. 1620-1628 (1991)
6. S. Nakamura, *GaN growth using GaN buffer layer*, Jpn. J. Appl. Phys., **Vol. 30** No. 10A, pp. L1705-L1707 (1991)
7. S. Nakamura, M. Senoh, T. Mukai, *Highly P-typed Mg-doped GaN films grown with GaN buffer layers*, Jpn. J. Appl. Phys., **Vol. 30** No. 10A, pp.L1708-L1711 (1991)
8. S. Nakamura, T. Mukai, M. Senoh, *High-power GaN P-N junction blue-light-emitting diodes*, Jpn. J. Appl. Phys., **Vol. 30** No. 12A, pp. L1998-L2001 (1991)
9. S. Nakamura, T. Mukai, M. Senoh, N. Iwasa, *Thermal annealing effects on P-type Mg-doped GaN films*, Jpn. J. Appl. Phys., **Vol. 31** No. 2B, pp. L139-L142 (1992)
10. S. Nakamura, N. Iwasa, M. Senoh, T. Mukai, *Hole compensation mechanism of P-type GaN films*,. Jpn. J. Appl. Phys., **Vol. 31** No. 5A, pp. 1258-1266 (1992)
11. S. Nakamura, T. Mukai, M. Senoh, *In situ monitoring and hall measurements of GaN growth with GaN buffer layers*, J. Appl. Phys., **Vol. 71**, No. 11, pp. 5543-5549. (1992)
12. S. Nakamura, T. Mukai, M. Senoh, *Si- and Ge-doped GaN films grown with GaN buffer layers*,. Jpn. J. Appl. Phys., **Vol. 31** No. 9A, pp. 2883-2888. (1992)
13. S. Nakamura, T. Mukai, *High-quality InGaN films grown on GaN films*, Jpn.J.Appl. Phys.,**Vol. 31** No.10B, pp. L1457-L1459. (1992).
14. S. Nakamura, M. Senoh, T. Mukai, *p-GaN/N-InGaN/N-GaN double-heterostructure blue-light-emitting diodes*, Jpn. J. Appl. Phys., **Vol. 32** No. 1A/B. pp. L8-L11 (1993)
15. S. Nakamura, T. Mukai, M. Senoh, *Si-doped InGaN films grown on GaN films*, Jpn. J. Appl. Phys., **Vol. 32** No. 1A/B, pp. L16-L19 (1993)
16. S. Nakamura, N. Iwasa, S. Nagahama, *Cd-doped InGaN films grown on GaN films*, Jpn. J. Appl. Phys., **Vol. 32** No. 3A, pp. L338-L341 (1993)
17. S. Nakamura, M. Senoh, T. Mukai, *High-power InGaN/GaN double-heterostructure violet light-emitting diodes*, Appl. Phys. Lett., **Vol. 62** No. 19, pp. 2390-2392 (1993)
18. S. Nakamura, *InGaN blue-light-emitting diodes*, Journal of the Institute of Electronics, Information and Communication Engineers, Vol. 76 No. 9, pp. 3911-3915 (1993)
19. S. Nakamura, T. Mukai, M. Senoh, S. Nagahama, N. Iwasa, *In/sub x-Ga/sub (1-x)-N/In/sub y-Ga/sub (1-y)-N superlattices grown on GaN films*. J. Appl. Phys., **Vol. 74** No. 6, pp. 3911-3915 (1993)

20. S. Nakamura, *Blue LEDs, realization of LCD by double-heterostructure*. No. 602, pp. 93-102 (1994)
21. S. Nakamura, T. Mukai, M. Senoh, *Candela-class high-brightness InGaN/AlGaIn double-heterostructure blue-light-emitting diodes*, Appl. Phys. Lett., **Vol. 64** No. 13, pp. 1687-1689 (1994)
22. S. Nakamura, *Nichia's Icd blue LED paves way for full-color display*. Nikkei Electronics Asia, June (1994).
23. S. Nakamura, *InGaN/AlGaIn double-heterostructure light-emitting diodes*, Extended Abstracts of the 1994 International Conference on Solid State Devices and Materials, JSAP, pp. 81-83. (1994)
24. S. Nakamura, *Realized high bright blue laser-emitting diodes*, Scientific American, October (1994)
25. S. Nakamura, *Growth of In/sub x-Ga/sub (1-x)-N compound semiconductors and high-power InGaN/AlGaIn double heterostructure violet-light-emitting-diodes*, Microelectronics Journal, **Vol. 25**, pp. 651-659 (1994)
26. S. Nakamura, *Zn-doped InGaIn growth and InGaIn/AlGaIn double-heterostructure blue-light-emitting diodes*, J. Cryst. Growth, Vol. 145, pp. 911-917 (1994)
27. S. Nakamura, *InGaIn/AlGaIn double-heterostructure blue LEDs*, Mat. Res. Symp. Proc., **Vol. 339**, pp. 173-178 (1994)
28. S. Nakamura, T. Mukai, M. Senoh, *High-brightness InGaIn/AlGaIn double heterostructure blue-green-light-emitting diodes*, J. Appl. Phys., **Vol. 76**, pp. 8189-8191 (1994)
29. S. Chichibu, T. Azhata, T. Sota, S. Nakamura, *Excitonic emissions from hexagonal GaN epitaxial layers*, J. Appl. Phys., **Vol. 79** No. 5, pp. 2784-2786 (1995)
30. S. Nakamura, *Highly luminous III-V nitride-based devices head for the highway, color displays*, IEEE, May (1995)
31. S. Nakamura, *InGaIn/AlGaIn blue-light-emitting diodes*, J. Vac. Sci. & Tech. A, **Vol. 13** No. 3, pp. 705-710 (1995)
32. S. Nakamura, *High-brightness InGaIn blue, green, and yellow light-emitting diodes with quantum well structures*, Jpn. J. Appl. Phys., **Vol. 34** No. 7A, pp. L797-L799 (1995)
33. S. Nakamura, *LED full color display*, IEICE, **Vol. 78**, No. 7, pp. 683-688 (1995)
34. S. Nakamura, *InGaIn light-emitting diodes with quantum well structures*, Extended Abstracts of the 1995 International Conference on Solid State Devices and Materials 08/21-24/95, Osaka, Japan (JSAP) (1995)
35. S. Nakamura, M. Senoh, N. Iwasa, S. Nagahama, Y. Yamada, T. Mukai, *Superbright green InGaIn single-quantum-well structure light-emitting diodes*, Jpn. J. Appl. Phys., **Vol. 34** No. 10B, pp. L1332-L1335 (1995)
36. S. Nakamura, M. Senoh, N. Iwasa, S. Nagahama, *High-power InGaIn single-quantum-well-structure blue and violet light-emitting diodes*, Appl. Phys. Lett., **Vol. 67** No. 13, pp. 1868-1870 (1995)
37. S. Nakamura, *Laser diodes and progress of InGaIn-based IV-V system LED*, Optik, **Vol. 24**, No. 11, pp. 673-678 (1995)
38. T. Azuhata, T. Soto, K. Suzuki, S. Nakamura, *Polarized Raman Spectra in GaN*, J. Phys. Condens. Matter, **Vol. 7** No. 10, pp. L129-L133 (1995)

39. S. Nakamura, *III-V Nitride light-emitting diodes*, OSA Proceedings on Advanced Solid-State Lasers, **Vol. 24**, pp. 20-24 (1995)
40. W.E. Carlos, E.R. Glaser, T.A. Kennedy, S. Nakamura, *Paramagnetic resonance in GaN-based light emitting diodes*, Appl. Phys. Lett., Vol. 67 No. 16, pp. 2376-2378 (1995)
41. S. Nakamura, *Recent developments of GaN based LEDs*, Proceedings of Topical Workshop on III-V Nitrides, pp. 11-14 (1995)
42. S. Chichibu, T. Azuhata, T. Sota, S. Nakamura, *Contribution of excitons in the photoluminescence spectra of h-GaN epitaxial layers grown on sapphire substrates by TF-MOCVD*, International Symposium on Blue Laser and Light Emitting Diodes, March 5-7, pp. 202-205 (1996)
43. S. Nakamura, M. Senoh, S. Nagahama, N. Iwasa, T. Yamada, T. Matsushita, H. Kiyoku, Y. Sugimoto, *InGaN-based multi-quantum-well-structure laser diodes*. Jpn. J. Appl. Phys., **Vol. 35** No. 1B, pp. L74-L76 (1996)
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45. S. Nakamura, *Pulsed operation of violet laser diodes*, Electr. Mater., March issue, pp. 159-164 (1996)
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47. S. Nakamura, M. Senoh, S. Nagahama, N. Iwasa, T. Yamada, T. Matsushita, H. Kiyoku, Y. Sugimoto, *Characteristics of InGaN multi-quantum-well-structure laser diodes*, Appl. Phys. Lett., **Vol. 68** No. 23, pp. 3269-3271 (1996)
48. S. Chichibu, A. Shikanai, T. Azuhata, T. Sota, A. Kuramata, K. Horino, S. Nakamura, *Effects of biaxial strain on exciton resonance energies of hexagonal GaN heteroepitaxial layers*, Appl. Phys. Lett., **Vol. 68** No. 26, pp. 3766-3768 (1996)
49. S. Nakamura, *InGaN-based blue/green LEDs and laser diodes*, Adv. Mater., **Vol. 8** No. 8, pp. 689-692 (1996)
50. S. Nakamura, M. Senoh, S. Nagahama, N. Iwasa, T. Yamada, T. Matsushita, Y. Sugimoto, H. Kiyoku, *Continuous-wave operation of InGaN multi-quantum-well-structure laser diodes at 233K*, Appl. Phys. Lett., **Vol. 69** No. 20, pp. 3034-3036 (1996)
51. S. Nakamura, M. Senoh, S. Nagahama, N. Iwasa, T. Yamada, T. Matsushita, Y. Sugimoto, H. Kiyoku, *Room-temperature continuous-wave operation of InGaN multi-quantum-well-structure laser diodes*, Appl. Phys. Lett., **Vol. 69** No. 26, pp. 4056-4058 (1996)
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56. S. Nakamura, *III-V nitride-based light-emitting diodes*, Diamond and Related Materials, **Vol. 5** Issue 1-3, pp. 496-500 (1996)
57. Y. Kawakami, Z.G. Peng, Y. Narukawa, Sz. Fujita, Sg. Fujita, S. Nakamura, *Recombination dynamics of excitons and biexcitons in hexagonal GaN epitaxial layer*, Appl. Phys. Lett., **Vol. 69** No. 10, pp. 1414-1416 (1996)
58. K. Okada, Y. Yamada, T. Taguchi, F. Sasaki, S. Kobayashi, T. Tani, S. Nakamura, G. Shinomiya, *Biexciton luminescence from GaN epitaxial layers*, Jpn. J. Appl. Phys., **Vol. 35** No. 6B, pp. L787-L789 (1996)
59. W. E. Carlos, E. R. Glaser, T. A. Kennedy, S. Nakamura, *Magnetic resonance studies of recombination processes in GaN light-emitting diodes*, Mat. Res. Soc. Symp. Proc. **395**, pp. 673-678 (1996)
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62. T. Taguchi, T. Maeda, Y. Yamada, S. Nakamura, G. Shinomiya, *Band edge emission of InGaN active epilayers in the high-brightness Nichia blue LEDs*, International Symposium on Blue Laser and Light Emitting Diodes, March 5-7, pp. 372-374 (1996)
63. S. Nakamura, *First successful III-V nitride based laser diodes*, International Symposium on Blue Laser and Light Emitting Diodes, March 5-7, pp. 119-124 (1996)
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66. T. Taguchi, Y. Yamada, K. Okada, T. Maeda, F. Sasaki, S. Kobayashi, T. Tani, S. Nakamura, G. Shinomiya, *Time-resolved luminescence spectroscopy of GaN and InGaN epitaxial layers under high density excitation*, 23rd ICPS Proc., Berlin, July 21-26, **Vol. 1**, pp. 541-544 (1996)
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68. S. Nakamura, M. Senoh, S. Nagahama, N. Iwasa, T. Yamada, T. Matsushita, Y. Sugimoto, H. Kiyoku, *Ridge-geometry InGaN multi-quantum-well-structure laser diodes*, Appl. Phys. Lett., **Vol. 69** No. 10, pp. 1477-1479 (1996)
69. S. Chichibu, T. Azuhata, T. Sota, S. Nakamura, *Excitonic emissions from hexagonal GaN epitaxial layers*, J. Appl. Phys., **Vol. 79** No. 5, pp. 2784-2786 (1996)
70. K. G. Zolina, V. E. Kudryashov, A. N. Turkin, A. E. Yunovich, S. Nakamura, *Luminescence spectra of superbright blue and green InGaN/AlGaIn/GaN light-emitting diodes*, MRS Internet Journal of Nitride Semiconductor Research, **Vol. 1** (1996)

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81. S. Nakamura, *Characteristics of RT-CW operated bluish-purple laser diodes*, Bulletin of Solid State Physics and Applications (1997)
82. Y. Narukawa, Y. Kawakami, M. Funato, S. Fujita, S. Fujita, S. Nakamura, *Role of self-formed InGaN quantum dots for exciton localization in the purple laser diode emitting at 420nm*, Appl. Phys. Lett., **Vol. 70** No. 8, pp. 981-983 (1997)
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84. S. Chichibu, T. Azuhata, T. Sota, S. Nakamura, *Luminescence from localized states in InGaN epilayers*, Appl. Phys. Lett., **Vol. 70** No. 21, pp. 2822-2824 (1997)
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87. S. Nakamura, *Success story with blue LEDs*, Science Journal Kagaku, **Vol. 67** No. 6, pp.438-450 (1997)
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96. S. Nakamura, *RT-CW operation of InGaN multi-quantum-well structure laser diodes*, Semiconductors & Semimetals, **Vol. 48**, pp. 391-443 (1997)
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107. S. Nakamura, *Characteristics of RT-CW operated InGaN multi-quantum-well-structure laser diodes*, MRS Internet J. Nitride Semicond. Res. 2, **5** (1997)
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PATENTS:

Patent

Title

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US5290393	Crystal growth method for gallium nitride-based compound semiconductor
US5334277	Method of vapor-growing semiconductor crystal and apparatus for vapor-growing the same
US5433169	Method of depositing a gallium nitride-based III-V group compound semiconductor crystal layer
US5468678	Method of manufacturing P-type compound semiconductor

US5563422 Gallium nitride-based III-V group compound semiconductor device and method of producing the same

US5578839 Light-emitting gallium nitride-based compound semiconductor device

US5652434 Gallium nitride-based III-V group compound semiconductor

US5734182 Light-emitting gallium nitride-based compound semiconductor device

US5747832 Light-emitting gallium nitride-based compound semiconductor device

US5767581 Gallium nitride-based III-V group compound semiconductor

US5777350 Nitride semiconductor light-emitting device

US5877558 Gallium nitride-based III-V group compound semiconductor

US5880486 Light-emitting gallium nitride-based compound semiconductor device

US5959307 Nitride semiconductor device

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US6093965 Gallium nitride-based III-V group compound semiconductor

US6153010 Method of growing nitride semiconductors, nitride semiconductor substrate and nitride semiconductor device

US6172382 Nitride semiconductor light-emitting and light-receiving devices

US6204512 Gallium nitride-based III-V group compound semiconductor device and method of producing the same

US6215133 Light-emitting gallium nitride-based compound semiconductor device

US6469323 Light-emitting gallium nitride-based compound semiconductor device

US6507041 Gallium nitride-based III-V group compound semiconductor

US6580099 Nitride semiconductor light-emitting devices

US6610995 Gallium nitride-based III-V group compound semiconductor

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US7122844 Susceptor for MOCVD reactor

US7186302 Non-polar (Al,B,In,Ga)N quantum well and heterostructure materials and devices

US7122844 Susceptor for MOCVD reactor

US7208393 Growth of planar reduced dislocation density m-plane gallium nitride by hydride vapor phase epitaxy

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US723998 White, single or multi-color light emitting diodes by recycling guided modes

US7332365 Method for fabricating group-III nitride devices and devices fabricated using method

US7335920 LED with current confinement structure and surface roughening

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EUROPE PATENTS

EP00497350B1 Crystal growth method for gallium nitride-based compound semiconductor

EP00497350B2 Crystal growth method for gallium nitride-based compound semiconductor

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JAPAN PATENTS:

特公平 07-083136 窒化ガリウム系化合物半導体発光素子
特公平 08-008217 窒化ガリウム系化合物半導体の結晶成長方法
特許 2141083 窒化ガリウム系化合物半導体発光素子
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特許 2540791 p型窒化ガリウム系化合物半導体の製造方法。
特許 2556211 半導体結晶層の成長装置とその成長方法
特許 2560963 窒化ガリウム系化合物半導体発光素子
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特許 2780691	窒化物半導体発光素子
特許 2783349	n型窒化ガリウム系化合物半導体層の電極及びその形成方法
特許 2785253	窒化ガリウム系化合物半導体のp型化方法
特許 2785254	窒化ガリウム系化合物半導体発光素子
特許 2790235	窒化ガリウム系化合物半導体のp型化方法
特許 2790237	多色発光素子
特許 2790242	窒化物半導体発光ダイオード
特許 2791448	発光ダイオード
特許 2795294	窒化ガリウムアルミニウム半導体の結晶成長方法。
特許 2800666	窒化ガリウム系化合物半導体レーザ素子
特許 2803741	窒化ガリウム系化合物半導体の電極形成方法
特許 2803742	窒化ガリウム系化合物半導体発光素子及びその電極形成方法
特許 2809045	窒化物半導体発光素子
特許 2812375	窒化ガリウム系化合物半導体の成長方法
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特許 2836685	p型窒化ガリウム系化合物半導体の製造方法
特許 2836686	窒化ガリウム系化合物半導体発光素子
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特許 2859478	発光デバイス用の窒化ガリウム系化合物半導体ウェハーの切断方法
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特許 2868081	窒化ガリウム系化合物半導体発光素子
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特許 2910023	窒化ガリウム系化合物半導体発光素子
特許 2910811	窒化ガリウム系化合物半導体ウェハーの切断方法
特許 2914014	窒化ガリウム系化合物半導体チップの製造方法
特許 2914065	青色発光素子及びその製造方法
特許 2917742	窒化ガリウム系化合物半導体発光素子とその製造方法
特許 2918139	窒化ガリウム系化合物半導体発光素子
特許 2921746	窒化物半導体レーザ素子
特許 3346735	窒化物半導体発光素子及びその製造方法
特許 2932467	窒化ガリウム系化合物半導体発光素子
特許 2932468	窒化ガリウム系化合物半導体発光素子
特許 2947047	LEDチップのリードフレームへのダイボンド方法
特許 2953326	窒化ガリウム系化合物半導体レーザ素子の製造方法
特許 2956489	窒化ガリウム系化合物半導体の結晶成長方法
特許 2964822	発光ダイオードの製造方法
特許 2976951	窒化物半導体発光ダイオードを備えた表示装置
特許 2982553	発光デバイスの製造方法
特許 2985908	窒化ガリウム系化合物半導体の結晶成長方法
特許 2998696	発光ダイオード
特許 3009091	青色発光ダイオード

特許 3009095	窒化物半導体発光素子
特許 3019132	窒化ガリウム系化合物半導体受光素子
特許 3036465	発光ダイオードを用いたディスプレイ
特許 3047960	n型窒化物半導体の電極
特許 3077781	窒化インジウムガリウムの成長方法
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特許 3091593	窒化物半導体発光デバイス用積層体
特許 3101997	窒化物半導体レーザ素子
特許 3129384	窒化物半導体レーザ素子
特許 3135041	窒化物半導体発光素子
特許 3141824	窒化物半導体発光素子
特許 3152238	発光ダイオード
特許 3154364	n型窒化ガリウム系化合物半導体層の電極及びその形成方法
特許 3180710	窒化ガリウム系化合物半導体発光素子の製造方法
特許 3180871	窒化ガリウム系化合物半導体発光素子およびその電極形成方法
特許 3187284	n型窒化物半導体層の電極
特許 3203282	発光デバイス用窒化インジウムガリウム半導体
特許 3209233	青色発光ダイオードおよびその製造方法
特許 3212008	窒化ガリウム系化合物半導体レーザ素子
特許 3216118	窒化物半導体素子及びその製造方法
特許 3218595	窒化物半導体レーザ素子及びその製造方法
特許 3216596	窒化ガリウム系化合物半導体発光素子
特許 3218963	窒化物半導体レーザ素子及びその製造方法
特許 3220977	窒化物半導体レーザ素子及び窒化物半導体レーザ素子の製造方法。
特許 3223810	窒化ガリウム系化合物半導体発光素子
特許 3223832	窒化物半導体素子及び半導体レーザダイオード
特許 3224020	窒化物半導体発光素子およびその製造方法
特許 3227287	窒化ガリウム系化合物半導体チップの製造方法と窒化ガリウム系化合物半導体素子
特許 3233258	窒化物半導体の電極
特許 3235440	窒化物半導体レーザ素子とその製造方法
特許 3241250	窒化物半導体レーザ素子
特許 3248564	窒化物半導体レーザダイオード
特許 3255224	窒化ガリウム系化合物半導体素子及びその製造方法
特許 3257344	窒化ガリウム系化合物半導体の結晶成長方法
特許 3257498	窒化ガリウム系化合物半導体の結晶成長方法
特許 3259811	窒化物半導体素子の製造方法及び窒化物半導体素子
特許 3267250	窒化物半導体発光素子
特許 3269070	窒化物半導体発光素子
特許 3271645	窒化物半導体発光ダイオード
特許 3271657	n型窒化ガリウム系化合物半導体の電極及びその形成方法
特許 3272588	窒化物半導体レーザ素子
特許 3274907	窒化インジウムガリウム化合物半導体の成長方法
特許 3275810	窒化物半導体発光素子
特許 3278108	窒化物半導体レーザ素子の製造方法
特許 3282174	窒化物半導体発光素子
特許 3282175	窒化物半導体素子

特許 3292083	窒化物半導体基板の製造方法及び窒化物半導体素子の製造方法
特許 3298390	窒化物半導体多色発光素子の製造方法
特許 3298454	窒化ガリウム系化合物半導体発光素子の製造方法
特許 3301345	p型窒化ガリウム系化合物半導体層の形成方法
特許 3301601	窒化物半導体発光素子
特許 3303645	窒化物半導体発光素子の製造方法
特許 3307218	窒化物半導体レーザ素子の製造方法
特許 3309953	窒化物半導体レーザダイオード
特許 3314620	窒化物半導体発光素子
特許 3314641	窒化物半導体レーザ素子
特許 3314666	窒化物半導体素子
特許 3314671	窒化物半導体素子
特許 3319585	窒化物半導体レーザ素子の製造方法
特許 3327170	発光ダイオードの製造方法
特許 3327179	窒化物半導体レーザ素子の製造方法
特許 3329753	窒化物半導体レーザ素子
特許 3334624	窒化物半導体レーザ素子
特許 3336599	窒化物半導体レーザ素子
特許 3339049	窒化物半導体レーザ素子
特許 3460581	窒化物半導体の成長方法及び窒化物半導体素子
特許 3272588	窒化物半導体レーザ素子
特許 3274907	窒化インジウムガリウム化合物半導体の成長方法
特許 3275810	窒化物半導体発光素子
特許 3278108	窒化物半導体レーザ素子の製造方法
特許 3282174	窒化物半導体発光素子
特許 3282175	窒化物半導体素子
特許 3292083	窒化物半導体基板の製造方法及び窒化物半導体素子の製造方法
特許 3298390	窒化物半導体多色発光素子の製造方法
特許 3298454	窒化ガリウム系化合物半導体発光素子の製造方法
特許 3301345	p型窒化ガリウム系化合物半導体層の形成方法
特許 3301601	窒化物半導体発光素子
特許 3303645	窒化物半導体発光素子の製造方法
特許 3307218	窒化物半導体レーザ素子の製造方法
特許 3309953	窒化物半導体レーザダイオード
特許 3314620	窒化物半導体発光素子
特許 3314641	窒化物半導体レーザ素子
特許 3314666	窒化物半導体素子
特許 3314671	窒化物半導体素子
特許 3319585	窒化物半導体レーザ素子の製造方法
特許 3327170	発光ダイオードの製造方法
特許 3327179	窒化物半導体レーザ素子の製造方法
特許 3329753	窒化物半導体レーザ素子
特許 3334624	窒化物半導体レーザ素子
特許 3336599	窒化物半導体レーザ素子
特許 3339049	窒化物半導体レーザ素子
特許 3344056	窒化ガリウム系化合物半導体発光素子及びその製造方法
特許 3344414	発光ダイオードを用いたディスプレイ

特許 3298390	窒化物半導体多色発光素子の製造方法
特許 3298454	窒化ガリウム系化合物半導体発光素子の製造方法
特許 3301345	p型窒化ガリウム系化合物半導体層の形成方法
特許 3301601	窒化物半導体発光素子
特許 3303645	窒化物半導体発光素子の製造方法
特許 3307218	窒化物半導体レーザ素子の製造方法
特許 3309953	窒化物半導体レーザダイオード
特許 3314620	窒化物半導体発光素子
特許 3314641	窒化物半導体レーザ素子
特許 3314666	窒化物半導体素子
特許 3314671	窒化物半導体素子
特許 3319585	窒化物半導体レーザ素子の製造方法
特許 3327170	発光ダイオードの製造方法
特許 3327179	窒化物半導体レーザ素子の製造方法
特許 3329753	窒化物半導体レーザ素子
特許 3334624	窒化物半導体レーザ素子
特許 3336599	窒化物半導体レーザ素子
特許 3339049	窒化物半導体レーザ素子
特許 3344056	窒化ガリウム系化合物半導体発光素子及びその製造方法
特許 3344414	発光ダイオードを用いたディスプレイ
特許 3360812	窒化物半導体素子
特許 3366188	窒化物半導体素子
特許 3366586	発光ダイオード
特許 3369089	窒化ガリウム系化合物半導体発光素子
特許 3371830	窒化物半導体発光素子
特許 3372226	窒化物半導体レーザ素子
特許 3374737	窒化物半導体素子
特許 3379619	窒化物半導体レーザ素子
特許 3395631	窒化物半導体素子及び窒化物半導体素子の製造方法
特許 3405334	窒化物半導体素子
特許 3424465	窒化物半導体素子及び窒化物半導体の成長方法
特許 3431389	窒化物半導体レーザ素子
特許 3433730	窒化物半導体発光素子
特許 3434162	窒化物半導体素子
特許 3438675	窒化物半導体の成長方法
特許 3441883	窒化物半導体レーザ素子
特許 3448196	窒化物半導体発光素子
特許 3454355	窒化ガリウム系化合物半導体発光素子
特許 3456413	窒化物半導体の成長方法及び窒化物半導体素子
特許 3468082	窒化物半導体素子
特許 3470712	窒化物半導体レーザ素子
特許 3473595	発光デバイス
特許 3476636	窒化物半導体レーザ素子
特許 3478090	窒化物半導体素子
特許 3478287	窒化ガリウム系化合物半導体の結晶成長方法と窒化ガリウム系化合物半導体
特許 3482955	窒化ガリウム系化合物半導体発光素子
特許 3484842	窒化物半導体レーザ素子

特許 3484997	窒化ガリウム系化合物半導体発光素子
特許 3496480	窒化物半導体素子
特許 3496512	窒化物半導体素子
特許 3502527	窒化物半導体レーザ素子
特許 3505167	窒化ガリウム系化合物半導体発光素子の製造方法
特許 3511970	窒化物半導体発光素子
特許 3523700	窒化物半導体レーザ素子
特許 3529286	窒化物半導体レーザ素子の製造方法
特許 3537977	窒化物半導体レーザ素子の製造方法
特許 3537984	窒化物半導体レーザ素子
特許 3538275	窒化物半導体発光素子
特許 3548442	窒化ガリウム系化合物半導体発光素子
特許 3551751	窒化物半導体の成長方法
特許 3557894	窒化物半導体基板および窒化物半導体素子
特許 3562455	窒化物半導体レーザ素子の形成方法
特許 3565202	窒化物半導体レーザ素子
特許 3593952	窒化物半導体レーザ素子
特許 3604205	窒化物半導体の成長方法
特許 3604278	窒化物半導体レーザー素子
特許 3617565	窒化物半導体レーザ素子
特許 3620292	窒化物半導体素子
特許 3622045	窒化物半導体レーザ素子及びその製造方法
特許 3645207	発光ダイオード
特許 3646649	窒化ガリウム系化合物半導体発光素子
特許 3647236	窒化物半導体レーザ素子
特許 3651260	窒化物半導体素子
特許 3656454	窒化物半導体レーザ素子
特許 3657795	発光素子
特許 3658112	窒化物半導体レーザダイオード
特許 3658892	p型窒化物半導体の成長方法及び窒化物半導体素子
特許 3659050	窒化物半導体の成長方法及び窒化物半導体素子
特許 3660446	窒化物半導体素子及びその製造方法
特許 3669848	窒化物半導体レーザ素子
特許 3679626	窒化ガリウム系化合物半導体チップ
特許 3685682	窒化物半導体レーザ素子
特許 3705047	窒化物半導体発光素子
特許 3724490	発光ダイオード
特許 3724498	発光ダイオード
特許 3744211	窒化物半導体素子
特許 3758562	窒化物半導体多色発光素子
特許 3767491	窒化ガリウム系化合物半導体発光素子
特許 3767534	発光デバイス
特許 3770014	窒化物半導体素子
特許 3772651	窒化物半導体レーザ素子
特許 3772807	窒化ガリウム系化合物半導体発光素子
特許 3775259	窒化物半導体レーザ素子
特許 3786000	窒化物半導体レーザダイオードとその製造方法

特許 3794530	窒化物半導体レーザ素子
特許 3800146	窒化物半導体素子の製造方法
特許 3801353	窒化物半導体発光素子
特許 3808892	発光ダイオード
特許 3809749	窒化物半導体発光素子
特許 3835225	窒化物半導体発光素子
特許 3835384	窒化物半導体素子
特許 3835446	窒化物半導体発光素子
特許 3847000	窒化物半導体基板上に活性層を備えた窒化物半導体層を有する窒化物半導体素子及びその成
特許 3857417	窒化物半導体素子
特許 3859356	窒化物半導体素子の製造方法
特許 3867625	窒化物半導体発光素子
特許 3876518	窒化物半導体基板の製造方法および窒化物半導体基板
特許 3884717	窒化ガリウム系化合物半導体の製造方法
特許 3885092	窒化物半導体レーザ素子およびその共振面の作製方法
特許 3888036	n型窒化物半導体の成長方法
特許 3888170	窒化物半導体レーザ素子
特許 3891108	窒化物半導体発光素子
特許 3893614	窒化物半導体レーザ素子のストライプ導波路の側面及び窒化物半導体層の平面に絶縁性の保護
特許 3920296	発光ダイオード
特許 3924973	窒化物半導体発光素子の製造方法および窒化物半導体発光素子
特許 3928621	発光素子用ウェハー
特許 3938101	発光素子の製造方法
特許 3941464	窒化物半導体発光素子の製造方法
特許 3951973	窒化物半導体素子
特許 3952079	窒化物半導体発光素子の製造方法
特許 3953077	窒化ガリウム系化合物半導体発光素子
特許 3956753	窒化ガリウム系化合物半導体発光素子
特許 3972943	窒化ガリウム系化合物半導体発光素子
特許 3992027	窒化物半導体レーザ素子
特許 3995011	発光ダイオード
特許 4028635	窒化物半導体発光素子
特許 4032836	窒化物半導体レーザ素子
特許 4043087	窒化物半導体素子の製造方法及び窒化物半導体素子
特許 4046114	窒化物半導体の成長方法及び窒化物半導体素子
特許 4053747	窒化物半導体レーザ素子
特許 4072202	窒化物半導体レーザ素子
特許 4109297	発光ダイオード
特許 4120698	窒化物半導体レーザ素子
特許 4131101	窒化物半導体素子の製造方法
特許 4197891	窒化物半導体レーザ素子
特許 4239444	窒化物半導体レーザダイオード
特許 4254373	窒化物半導体素子
特許 4277283	窒化物半導体発光素子
特許 4285337	窒化ガリウム系化合物半導体ウェハーの製造方法