※大學學術追求卓越發展延續計畫執行報告格式

Explanation for the Form of the Annual/Midterm/Final Report "Program for Promoting Academic Excellence of Universities（Phase II）"

※ The Annual/Midterm/Final Report contains the following sections:

(Add extra lines or columns if needed.)

I. COVER

Program for Promoting Academic Excellence of Universities (Phase II)

Final Report

建構兆位元紀元的光電科技-子計畫一：兆位元時代光電科技之基礎研究

Photonic Sciences and Technologies for the Tera Era:

Subproject 1: Fundamental Studies on Photonic Science and Technology for the Tera Era

NSC 93-2752-E-009-008-PAE
NSC 94-2752-E-009-007-PAE
NSC 95-2752-E-009-007-PAE
NSC 96-2752-E-009-007-PAE

Overall Duration: Month 4 Year 2004 - Month 3 Year 2008
Report Duration: Month 4 Year 2004 - Month 3 Year 2008

National Chiao Tung University
2008.05.02

II. (Form1) Basic Information of this Sub-Project (Form2)

<table>
<tr><td colspan="6">Project Title: Photonic Sciences and Technologies for the Tera Era--Subproject 1: Fundamental Studies of Photonic Science and Technology for the Tera-era
建構兆位元紀元的光電科技-子計畫一：兆位元時代光電科技之基礎研究</td></tr>
<tr><td colspan="3">Serial No.: NSC 94-2752-E-009-007-PAE</td><td colspan="2">Affiliation</td><td>National Chiao Tung University
國立交通大學</td></tr>
<tr><td rowspan="4">Principal Investigator</td><td>Name</td><td>Ci-Ling Pan
潘犀靈</td><td rowspan="4">Project Coordinator</td><td>Name</td><td>Hao-Chung Kuo
郭浩中</td></tr>
<tr><td>Tel:</td><td>(03)5712121-31921</td><td>Tel:</td><td>(03)5712121-31986</td></tr>
<tr><td>Fax:</td><td>(03)5716631</td><td>Fax:</td><td>(03)5716631</td></tr>
<tr><td>E-mail</td><td>clpan@faculty.nctu.edu.tw</td><td>E-mail</td><td>hckuo@faculty.nctu.edu.tw</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td colspan="2">Expenditures[1] (in NT$1,000)</td><td colspan="2">Manpower[2]:Full time/Part time(Person-Months)</td></tr>
<tr><td>Projected</td><td>Actual</td><td>Projected</td><td>Actual</td></tr>
<tr><td>FY2004</td><td>11,786</td><td>11,786</td><td>50</td><td>50</td></tr>
<tr><td>FY2005</td><td>12,947</td><td>12,947</td><td>50</td><td>50</td></tr>
<tr><td>FY2006</td><td>12,948</td><td>12,948</td><td>50</td><td>50</td></tr>
<tr><td>FY2007</td><td>13,446</td><td>13,446</td><td>50</td><td>48</td></tr>
<tr><td>Overall</td><td>51,127</td><td>51,127</td><td>200</td><td>198</td></tr>
</table>

Notes: [1,2] Please explain large differences between projected and actual figures.

Principal Investigator's Signature:

III. (Form 2) List of Works, Expenditures, Manpower, and Matching Supports from the Participating Institutes（Reality）.

96 年度

Research Item (Include sub projects)	Major tasks and objectives	Expenditures (in NT$1,000)					Manpower (person-month)					Matching Supports from the Participating Institutes (in English & Chinese)
Serial No.:	Program Title: (in both English & Chinese)											
		Salary	Seminar/ Conference-related expenses	Project-related expenses	Cost for Hardware & Software	Total	Principal Investigators	Consultants	Research/ Teaching Personnel	Supporting Staff	Total	
Fundamental Studies on Photonic Science and Technology for the Tera Era	Generation of coherent infrared radiation	1802	396	1572	583	4353	4				4	
	Population-split genetic algorithm	1925	380	2008	561	4874	4			16	20	
	Near-infrared fs laser crystallized polycrystalline silicon TFT	1969	423	1157.6	589.3	4138.9	8			28	36	
	A powerful THz emitter in the 800nm wavelength regime	1824	350	1550	498	4222	8			20	28	
	All-Optical Nework Components	1699	380	1410.2	563	4052.2	4			12	16	
	High-Speed Optical Receivers	2000	372	10010	568	12950	4			24	28	
	GaN-based a Light Emitting Diodes	1903	408	1291.2	569	4171.2	4			16	20	
	GaN-based VCSEL	1703	411.7	940	521	3575.7	4			16	20	
	Photonic Crystal Microcavity Lasers	2045.9	402.3	1664	601	4713.2	4			14	20	
	the optimization of our doped PMMA photopolymers	1826.7	446	912.4	583	3768.1	8				8	
SUM		18,697.6	3,969	22,515.4	5,636.3	508,18.3	52			146	198	

IV. (Form 3) Statistics on Research Outcome of this Program

96 年度

Listing		Total	Domestic	International	Significant[1]	Citations[2]	Technology Transfer
Published Articles	Journals	257	0	242	15		
	Conferences	389	171	186	32		
	Technology Reports	0	0	0	0		
Patents	Pending	1	1	0	0		
	Granted	22	14	8	0-		
Copyrighted Inventions	Item	0	0	0	0	0	
Workshops/Conferences[3]	Item	41	16	25	0		
	Participants	41	16	25	0		
Training Courses（Workshops/Conferences）	Hours	0	0	0	0		
	Participants	0	0	0	0		
Personal Achievements	Honors/ Awards[4]	18	11	7	0		
	Keynotes Given by PIs	1	0	1	0		
	Editor for Journals	4	0	4	0		
Technology Transfers	Item	3	3	0			
	Licensing Fee	1,000,000+	1,000,000+	0	0		
	Royalty	0	0	0			
Industry Standards[5]	Item	0	0	0	0	0	
Technological Services[6]	Item	0	0	0	-	-	-
	Service Fee	0	0	0	-	-	-

[1] Indicate the number of items that are significant. The criterion for "significant" is defined by the PIs of the program. For example, it may refer to Top journals (i.e., those with impact factors in the upper 15%) in the area of research, or conferences that are very selective in accepting submitted papers (i.e., at an acceptance rate no greater than 30%). Please specify the criteria in Appendix IV.

[2] Indicate the number of citations. The criterion for "citations" refers to citations by other research teams, i.e., exclude self-citations.

[3] Refers to the workshop and conferences hosted by the program.

[4] Includes Laureate of Nobel Prize, Member of Academia Sinica or equivalent, fellow of major international academic societies, etc.
[5] Refers to industry standards approved by national or international standardization parties that are proposed by PIs of the program.
[6] Refers to research outcomes used to provide technological services, including research and educational programs, to other ministries of the government or professional societies.

V. (FORM4) EXECUTIVE SUMMARY ON RESEARCH OUTCOMES OF THIS PROGRAM

(PLEASE STATE THE FOLLOWING CONCISELY AND CLEARLY)

1. GENERAL DESCRIPTION OF THE PROJECT: INCLUDING OBJECTIVES OF THE PROJECT (MAXIMUM 3 PAGES)

The main goals of this project are to design, construct and characterize new optical and optoelectronic functional devices and modules to meet the challenge of the tera-bit information era. To achieve these goals, we focus our research on the following fundamental research topics:

(I) Coherent and THz Photonics;
(II) Quantum (Photonic Crystal) structures and Enabling devices;
(III) Volume Holographic Materials, Technology and Enabling devices

(I) Coherent and THz Photonics

One of the current trends in photonics is the development of a technology based with better control of the light-matter interaction. Employing advanced laser-based techniques, novel design concept, and fabrication technologies of novel photonic structures from potential photonic materials, we shall be able to steer photon energies into specific degrees of freedom of complex systems or materials, to create new materials, to generate new functionality from a device. One of the goals of the present project is thus the development and employment of advanced laser technology, in particular, ultrafast-laser-based techniques such as coherent control, spatially, temporally, and spectrally resolved real-time imaging, and laser-assisted fabrication and properties modification for fundamental studies of photonic properties of various novel photonic materials, structures and devices.

In view of the emerging applications of electromagnetic waves at millimeter-wave or THz frequencies in remote sensing, imaging, and communication, we will conduct studies on various aspects of THz photonics and applications, employing the coherent photonic tools developed in our laboratories over the years.

One of our main objectives is the building a technology base of photonics-based ultra-wideband (THz) wireless communication and frequency measuring technologies for the next generation. The advances in THz applications would also require concurrent progress in THz photonic elements, such as generators, detectors, polarizers, attenuators, modulators and phase shifters. Novel materials and structures need be explored to address this requirement. Topics include (1) highly efficient THz emitters and detectors, (2) exploration of the possibility of combining liquid crystals with photonic crystals and meta-materials for tunable THz optics. With the structured material or meta-material and highly birefringent materials such as liquid crystals for added functionality, new possibilities arise for novel optical elements because of the strong coupling of these novel materials with the electromagnetic wave. Starting from the theoretical analysis, we will work on design and fabrication of various THz optical components. Our long-range goal would be highly directional and intense THz sources, taking advantage of the unique properties of photonic crystals or meta-materials. The technologies developed in this project would also make possible advances in other important applications of THz science and technology, e.g., biomedical sensing and imaging.

(II) Quantum (Photonic Crystal) structures and Enabling devices

The main objectives of this research project will be focus on 3 parts. First, Development and study of novel blue and UV-LED and surface emitting laser, the specific objectives of this proposal include (1) to development nitride-based blue and UV material and optoeletronic device; (2) to development novel process for obtaining high performance of blue and UV LED and LD. Second, to investigate nanotechnology and nano-photonics. This part of the object will focus on investigating the optical properties of mesoscopic GaN-based quantum confined structures and to achieve controlled photon emission from the GaN-based quantum confined structures. The specific objectives of this proposal include (1) establishment of the fabrication technology of GaN quantum confined structures such as quantum dots and nanostructures; (2) simulation and modeling of the op;tical properties of microcavity quantum confined structures and development of device design guidelines for fabrication of microcavity quantum confined structures; (3) fabrication of devices that incorporate the quantum confined structures into a microcavity such as vertical cavity surface emitting laser (VCSEL) structures; (4) investigation of the optical properties of the fabricated quantum confined structures and microcavity structures; and (5) investigation and demonstration of the controlled photon emission from the microcavity quantum confined structures or devices. Third, for the fabrication of long wavelength VCSEL (LW-VCSEL) and high speed VCSEL for communication, the specific objectives of this proposal include (1) fabrication single mode high speed GaAs or InP -based VCSEL; fabrication of InP based 1300 nm or 1500nm Long Wavelength VCSEL; (2) VCSEL Arrays Chip and Multiple-Wavelength or tunable Source.

- The GaN-based UV LD have applicatics to the high density storge in the storge project..
- The Long Wavelength VCSEL will be useful to the optical communication project.

(III) Volume Holographic Materials, Technology and Enabling devices

Volume holographic technology and applications have been explored for past 50 years but still have not yet achieved significant breakthrough. The development of the proper recording material is a fundamental key to the success for the holographic systems. Therefore, in this sub-project, we plan to develop novel volume holographic materials and explore its applications on novel information processing with ultrahigh density (1 Tbits/in2) and ultrafast fast (Tbps). Through the innovative researches and international collaborative efforts, we anticipate becoming a world class leader in the field of parallel information photonic system.

2. Breakthroughs and Major Achievements

1. Advanced laser technology and applications

In collaboration with Prof. Andy H. Kung, we have developed novel spatial light modulators that enable generation of Sub-Single-Cycle (0.83 cycles long and an electric field pulse width of 0. 44 fs) optical pulse train with constant carrier envelope phase by molecular modulation in H_2. [Phys. Rev. Lett. 100:163906, 2008]. Major achievements in ultrafast fiber lasers include report of self-steepening of prechirped amplified and compressed 29-fs fiber laser pulse in large-mode-area erbium-doped fiber amplifier [OSA/IEEE J. Lightwave Technol., 25(11): 3597, 2007]. We also showed that femtosecond laser annealing (FLA) as a novel approach for recrystallization of amorphous silicon (a-Si) for TFT applications [reported at CLEO2003 as a news story; APL **85**(7):1232, 2004, *selected by the Virtual Journal of Ultrafast Science, September 2004*, ROC patent I245321], dopant profile engineering [APL **88**:1311104, 2006, selected by V*irtual J. of Nanoscale Sci. and Technol.,* and *Virtual J. of Ultrafast Sci.*]. Laser-recrystallized material was used successfully for fabricating thin film transitors [*Opt. Exp.*, **15**: 6981, 2007, selected by *Virtual J. of Ultrafast Sci.*].

2. THz photonic elements with liquid-crystal-enabled functionalities

We have pioneered this field. The optical constants of several important liquid crystals were determined in the THz regime for the first time. Unexpected large birefringence was observed for the liquid crystals 5CB and E7 in the nematic phase. These properties were utilized to demonstrate both magnetically and electrically controlled THz phase shifters, culminating in *the first room-temperature, 0-2π tunable THz phase shifter* [Opt. Exp. 12(12): 2625, 2004, Selected by *the Virtual Journal of Ultrafast Science*, *September 2004*, *Taiwan Patent 200186, US patent filed*]. The device operates at room temperature, as opposed to previous devices needing liquid N_2 for cooling and achieving phase shift of a few degrees at best. Important applications such as THz phased arrayed radar would be possible. Our work on THz photonic elements with liquid-crystal-enabled functionalities was highlighted by SPIE Newsroom (http://spie.org/x14608.xml).

3. Highly efficient Blue LED and Electrically pumped GaN VECSEL

We report the first ever electrically pumped GaN VCSEL. The laser, which has the potential to be used in high-density optical storage and laser printing applications, produced continuous-wave 462 nm emission with a linewidth of 0.15 nm at 77K. Details of the device, the culmination of eight years of VCSEL development [Appl. Phys. Lett. 92:141102, 2008, reported by Compound Semiconductors Magazine, April 2008]. We have also demonstrated high light-extraction (external quantum efficiency ~40%) 465-nm GaN-based vertical light-emitting diodes (LEDs) employing double diffuse surfaces. The high scattering efficiency of double diffused surfaces could be responsible for the high light output power. The calculated external quantum efficiency of our proposal LEDs with double diffuse surfaces is about 40% at 20mA (λ ~ 465 nm), which could compete with structures of state of the art.

1. Development and study of novel blue and UV-LED

We successfully improved the performance of LEDs using two methods:

(1) Enhancement of flip-chip light-emitting diodes with Omnidirectional reflector and textured micropillar arrays

The light output power of the FC-LED was increased by 65% for a 3.2-μm textured micropillar on the bottom side of the sapphire substrate

(2) High Light-Extraction GaN-based Vertical LEDs With Double Diffuse Surfaces

The calculated external quantum efficiency of our proposal LEDs with double diffuse surfaces is about 40% at 20mA (λ~465 nm), which could compete with structures of state of the art.

(3) Fabrication and Characterization of GaN-based LEDs Grown on Chemical Wet-etched Patterned Sapphire Substrates (CWE-PSS)

(4) Trenched epitaxial lateral overgrowth of fast coalesced a-plane GaN with low dislocation density

We have grown high quality and fully coalesced a-plane GaN films at the thickness of 10 μm by using trenched epitaxial lateral overgrowth (TELOG) with a 2 μm seed/18 μm trench stripe pattern

(5) Enhancement of light output intensity by integrating ZnO nanorod arrays on GaN-based LLO vertical LEDs

The light output intensity and wall-plug efficiency of the GaN-based LLO vertical LED with the omnidirectional extraction surface by ZnO nanorod arrays shows 38.9 and 41.2% increases, respectively, at 200 mA current injections compared to that of a vertical LED without ZnO nanorod arrays

(6) High-Performance GaN-based vertical-injection light-emitting diodes with TiO_2–SiO_2 Omnidirectional reflector and n-GaN roughness

With the help of laser lift-off and photo-electrochemical etching technologies, at a driving current of 350 mA and with chip size of 1 mm × 1 mm, the light–output power and the external quantum efficiency of our thin-film LED with TiO_2–SiO_2 ODR reached 330 mW and 26.7%. The result demonstrated 18% power enhancement when compared with the results from the thin-film LED with Al reflector replace.

(7) Study of high reflectivity mirror for blue high quality light emitter

Using a crack-free GaN/AlN DBR incorporated with GaN/AlN superlattice (SL) layers was successfully grown on a c-plane sapphire substrate to achieve high quality light emitter.

1. Development and study of nanotechnology, nano-photonics, and surface emission laser

(1) InGaN/GaN nanostripe grown on pattern sapphire by metal organic chemical vapor deposition

These MQW nano-stripe arrays are capable of enhancing luminescence and appear to be suitable for application to the fabrication of high-efficiency light-emitting devices.

(2) Successfully achieved the Lasing Action of GaN-based Two Dimensional Surface-emitting Photonic Crystal Laser

The lasing wavelength located at 424.3 nm, and the FWHM of the laser is around 0.11 nm. Other devices also could be observed the lasing actions occur at the similar threshold energy but different lasing

(3) Fabrication of InGaN/GaN MQW Nanorods LED by ICP-RIE and PEC Oxidation Process with Self-Assembly Ni Metal Islands

An enhancement by a factor of 6/5 times in photoluminescence intensities of nanorods with/without PEC process compared to that of as-grown structure. The peak wavelength observed from PL measurement shows a blue shift of 3.8 nm of the nanorods without PEC oxidation process and 8.6 nm of the nanorods with PEC oxidation process from that of the as-grown LED sample.

3. Development and study of blue VCSEL

(1) Study of high Q micro-cavity light emitting diode (MCLED)

The MCLED shows that the emission intensity superlinearly increased with a very narrow linewidth of 0.52 nm equivalents to cavity Q value of 895 at driving current of 10 mA and a dominant emission peak wavelength at 465.3 nm

(2) Emission characteristics of optically pumped GaN-based vertical-cavity surface-emitting lasers

The laser emitted wavelength at 415.9 nm with an emission linewidth of 0.25 nm and threshold pumping energy of 270 nJ. The laser has a high characteristic temperature of about 278 K and high spontaneous emission coupling factor of 10−2. The laser emission showed single and multiple spot emission patterns with spectral and spatial variations under different pumping conditions.

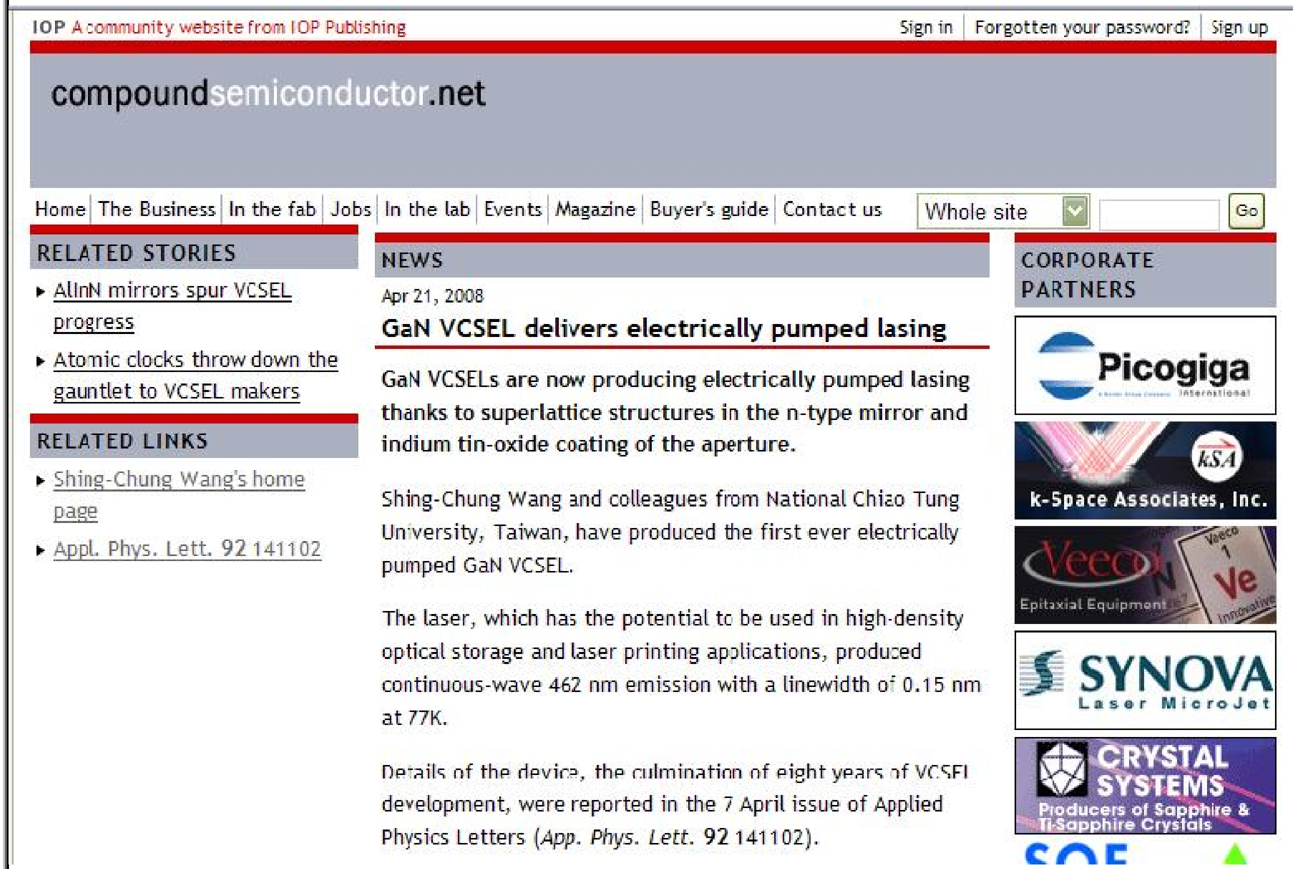
(4) Study of characteristics of GaN vertical cavity surface emitting laser (VCSEL)

The GaN VCSEL emits a blue wavelength at 448 nm with a linewidth of 0.17 nm with a near-field emission spot diameter of about 3μm. The laser beam has a near linear polarization with a degree of polarization of about 84%.

(5) Successfully fabricated low-temperature electrical pumping InGaN-MQW VCSELs by hybrid mirrors

The center wavelength is at 465nm and a distinct narrow linewidth of the peak is nearluy 5.2Å which can be calculated the cavity quality factor (Q) about 894

First Electrical Pumping VCSEL Results


IOP A community website from IOP Publishing

Sign in | Forgotten your password? | Sign up

compoundsemiconductor.net

Home | The Business | In the fab | Jobs | In the lab | Events | Magazine | Buyer's guide | Contact us | Whole site | Go

RELATED STORIES

- AlInN mirrors spur VCSEL progress
- Atomic clocks throw down the gauntlet to VCSEL makers

RELATED LINKS

- Shing-Chung Wang's home page
- Appl. Phys. Lett. 92 141102

NEWS

Apr 21, 2008

GaN VCSEL delivers electrically pumped lasing

GaN VCSELs are now producing electrically pumped lasing thanks to superlattice structures in the n-type mirror and indium tin-oxide coating of the aperture.

Shing-Chung Wang and colleagues from National Chiao Tung University, Taiwan, have produced the first ever electrically pumped GaN VCSEL.

The laser, which has the potential to be used in high-density optical storage and laser printing applications, produced continuous-wave 462 nm emission with a linewidth of 0.15 nm at 77K.

Details of the device, the culmination of eight years of VCSEL development, were reported in the 7 April issue of Applied Physics Letters (*App. Phys. Lett.* 92 141102).

CORPORATE PARTNERS

4. Utra-low shrinkage holographic photopolymer

We have fabricated high-optical-quality large photoplymer disk (120mm diameter, 2mm thick) and bulk (2.5×4.0×10.0 cm^3) samples for volume holographic storage. [J. of Non. Opt. Phys. and Mats., Vol. 15(2), 239, 2006; ICO book Chapter, in press, 2008.] This photopolymer exhibits negligible shrinkage effect during holographic recording. Sub-tera-byte capacity (~450GB) was demonstrated for a 5-inch disk. The physical mechanism of holographic recording in doped PMMA has also been investigated and provides hints to improve holographic properties. [Opt. Communs., 281, 559-566, 2008] Further, we have developed world's first Fe, Ru, Mn, doped $Bi_4Ge_3O_{12}$ photorefractive crystals for Red and NIR holographic recording. [Opt. Communs., 37-43, January 2008.] By use of our thick recording materials, we have also developed volume holographic technology for measuring 3D-fluid flow fielding micro-channel. [J. Optical Memory & Neural Networks, Vol., 14 (2), 129-135, 2006.]

3. Categorized Summary of Research Outcomes. In each research area, please give a brief summary of the research outcomes associated with the area. Note that the summaries should be consistent with the statistics given in Form 3. Please list and number of each research outcomes in order in Appendix II, and list all the publications in top conferences and journals in Appendix III.

A. Coherent and THz Photonics

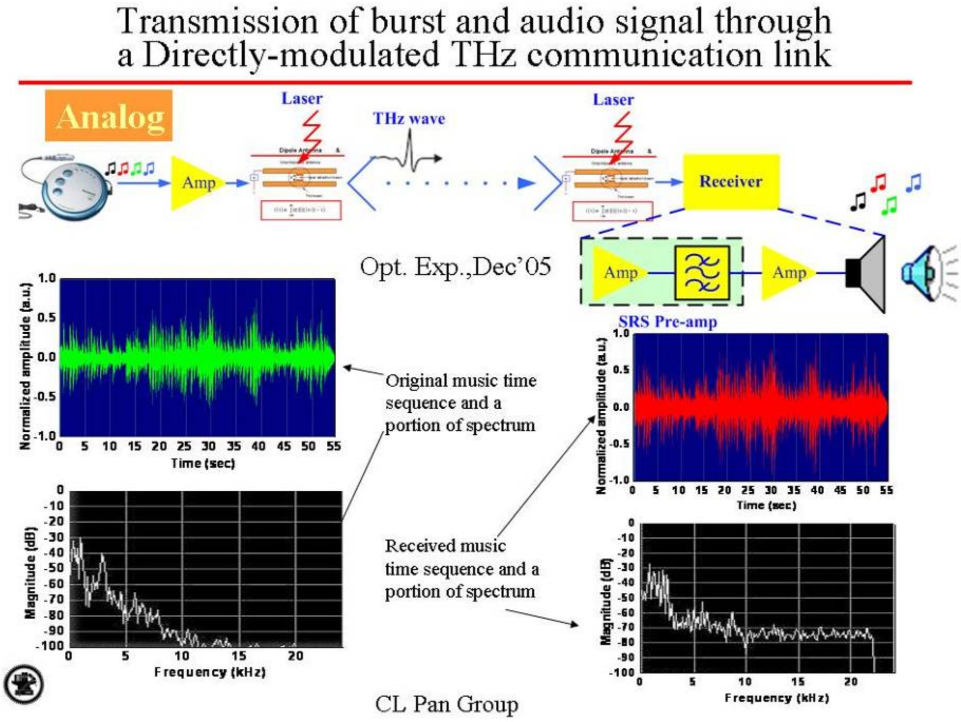
Profs. Ci-Ling Pan, Ru-Pin Chao Pan, Jung Y. Huang, Gong-Ru Lin and Jin-Wei Hsu

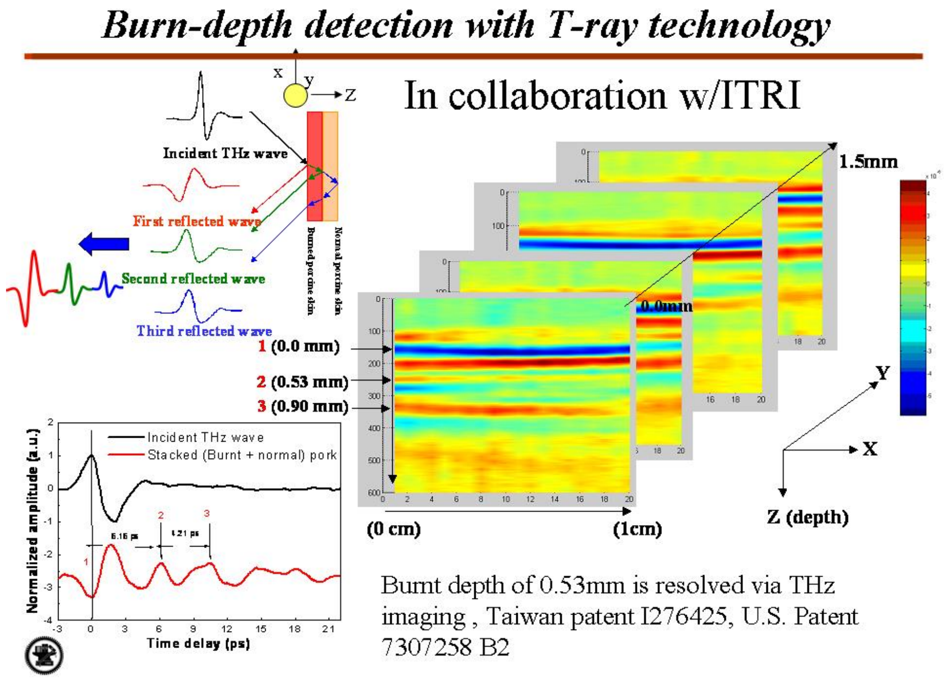
Major research outcomes in this area include generation of sub-single-cycle optical pulses, adaptic coherent control, *dipole antennas with detection bandwidth exceeding 30 THz*, a record for ion-implanted photoconductors (OptExp'04, selected by the AIP virtual journal), first directly-modulated THz communication link for audio and burst signals (Opt Exp'05). Prof. Pans' group also pioneered the field of Liquid Crystal THz Photonics, achieving the first room-temperature, 0-2π tunable THz phase shifter [OptExp04, selected by the AIP Virtual Journal, Taiwan Patent 200186, US patent pending], an important milestone for THz phased array applications. The work on other liquid-crystal-enabled THz functional devices such as a tunable THz Lyot filter (APL'06, Taiwan and U.S. patents pending) was highlighted by SPIE Newsroom (http://spie.org/x14608.xml). In collaboration with ITRI, the NCTU team has developed a THz System for Detecting of biological tissue burn trauma (Taiwan patent I276425, U. S. patent 7307258 B2). In collaboration with Prof. Jin-Wei Shi, Prof. Pan and co-workers have developed high-speed optical detectors and THz photonic transmitters with bandwidth beyond several hundred GHz (APL'06, PTL'07, PTL'08). In collaboration with Prof. Chi-Kuang Sun (NTU), we have reported low-loss hollow-core THz fiber wave guide [APL'08, highlighted by Nature Photonics, April 2008]. Scanning and interferometric THz fiber endoscopic imaging was also demonstrated (APL'08, OptExp'08).

1. Ultrabroad band THz field detector based on Arsenic-ion-implanted GaAs and proton-bombarded InP (Prof. Ci-Ling Pan):

A detection bandwidth exceeding 30 THz was reported for THz dipole antenna fabricated on $InP:H^+$ [Opt. Exp. 12(13):2954, 2004, *selected by the Virtual J. of Ultrafast Sci., August 2004*]. This is an extension of our previous work on Arsenic-ion-implanted GaAs [APL 83(7)1322, 2003, *selected by the Virtual J. of Ultrafast Sci., September, 2003*]. Both types of devices exhibit the broadest bandwidth reported for THz antennas based on ion-implanted photoconductors and comparable to that of LT-GaAs, the current state-of-art material for such applications. A photoconductive THz Spiral Antenna fabricated on multi-Energy Arsenic-Ion-Implanted GaAs also was well-received [JAP 98:013711, 2005. *Selected by the Virtual J. of Ultrafast Sci., August 2005*]. Such antennas were used for the first directly-modulated THz communication link for audio and burst signals (Opt Exp 13, 10416-10423, 2005) In collaboration with ITRI, the NCTU team has developed a THz System for Detecting of biological tissue burn trauma (Taiwan patent I276425, U.

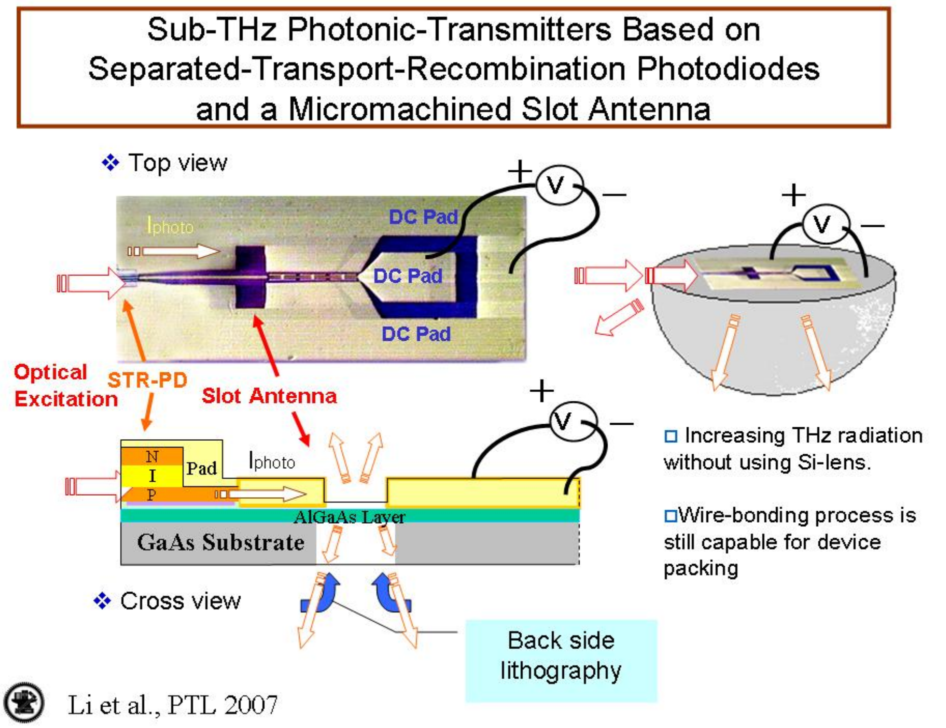
S. patent 7307258 B2).



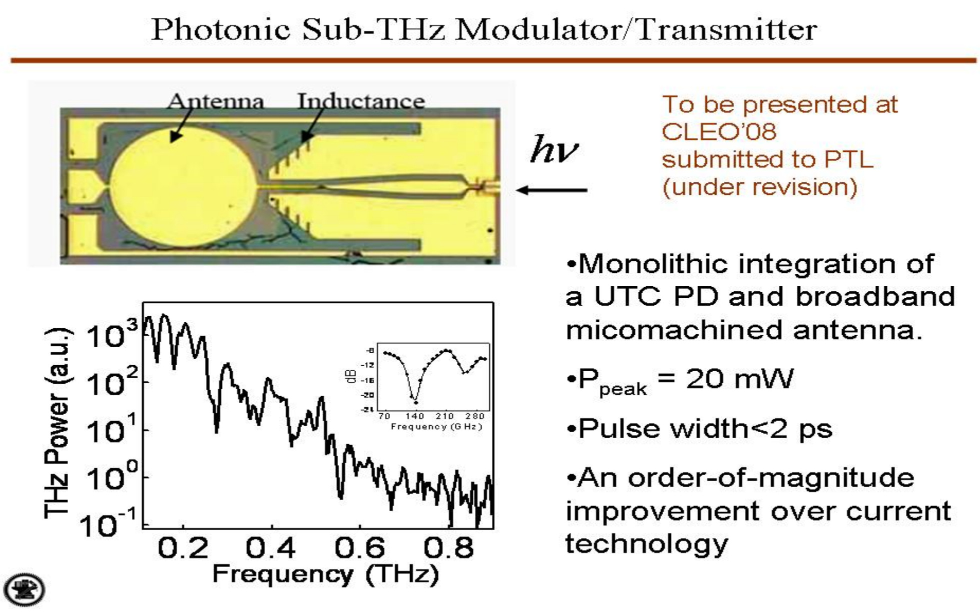


2. Novel Photonic THz Transmitters (Profs. Jin-Wei Shi and Ci-Ling Pan)

We have investigated two types of sub-THz Photonic-Transmitters. The first design is based on Separated-Transport-Recombination Photodiodes (STR-PD) based on low-temperature MBE-grown GaAs (LTG-GaAs) and a Micromachined Slot Antenna [PTL 19:840, 2007]. Under femtosecond optical pulse illumination, this device radiates strong electrical pulses (4.5-mW peak power) without the use of a Si-lens. The peak power is as high as 300 μW, occuring at 500 GHz, which corresponds to the designed resonant frequency of the slot antenna. The saturation problem related to the output terahertz power that occurs with the traditional LTG-GaAs-based photonic-transmitters when operated under high external applied electrical fields (50 kV/cm) has been eliminated by the use of our device.

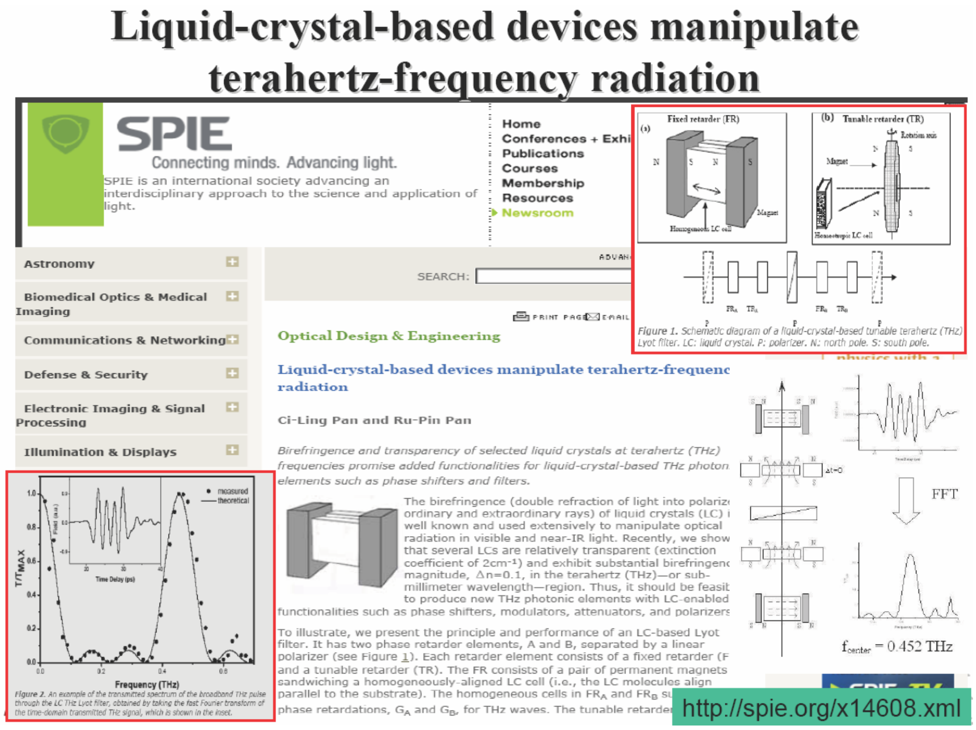


An alternative design, appropriate for wireless THz impulse-radio (IR) communication, is realized by monolithic integration of a GaAs/AlGaAs based uni-traveling-carrier (UTC) photodiode with a substrate-removed broadband antenna. The device can radiate strong sub-THz pulses (20mW peak-power) with a narrow pulse-width (<2ps) and wide bandwidth (100~250GHz). The maximum average power emitted by our device, under the same THz time-domain spectroscopic setup, is around 10 times higher than that of the low-temperature-grown GaAs based photoconductive antenna, whilst with a much lower DC bias (9V vs. 35V). [PTL, to appear 2008].



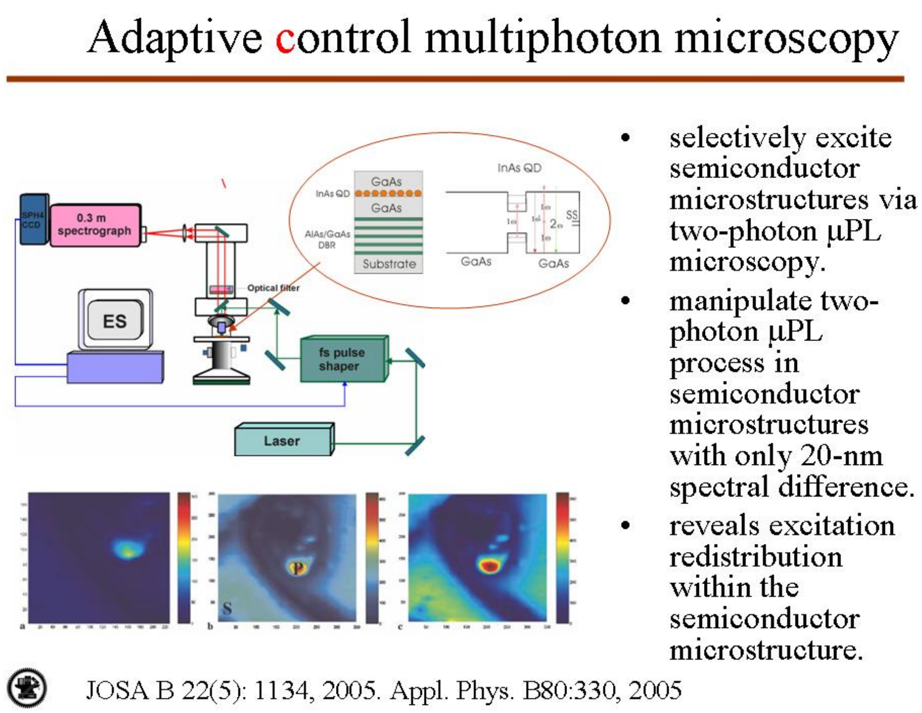
3. Liquid crystal THz photonics (Prof. Ci-Ling Pan and Ru-Pin Pan)

We have pioneered this field. The optical constants of several important liquid crystals were determined in the THz regime for the first time [*Appl. Opt.*, 42(13): 2372, 2003 and *J. Biological Phys.* 29(2-3):335, 2003, *J. Appl. Phys.* 103: 101809, 2008, *Ferroelectrics*, to appear 2008]. Unexpected large birefringence was observed for the liquid crystals 5CB and E7 in the nematic phase. These properties were utilized to demonstrate both magnetically and electrically controlled THz phase shifters [*APL* 83(22): 4497, 2003; *IEEE MWCL* 14(2):77, 2004,], culminating in *the first room-temperature, 0-2π tunable THz phase shifter* [*Opt. Exp.* 12(12): 2625, 2004, Selected by *the Virtual J. Ultrafast Sci.*, *September 2004*, *Taiwan Patent 200186, US patent filed*]. The device operates at room temperature, as opposed to previous devices needing liquid N_2 for cooling and achieving phase shift of a few degrees at best. Important applications such as THz phased arrayed radar would be possible. Recently, we also reported control of enhanced THz transmission through 2-D metallic hole arrays using magnetically controlled birefringence in a nematic liquid crystal cell. [*Opt. Exp.* 13(11): 3921, 2005, collected by the Nanostructured Surfaces Web]. The first ever THz Lyot filter [*APL* 88:101107, 2006, collected by *the Virtual J. of THz Sci. and Technol.*], electrically switchable THz quarter-wave plate [OL 31(8):1112, 2006, collected by *the Virtual J. of THz Science and Technology*, OSA *Virtual J. Biomed. Opt.*] and electrically tunable room-temperature 2π Liquid Crystal Terahertz Phase Shifter [IEEE PTL 18(14): 1488, July 15, 2006, collected by *Virtual J. of THz Sci. and Technol., July* 2006] were demonstrated recently. Our work on THz photonic elements with liquid-crystal-enabled functionalities was highlighted by SPIE Newsroom (http://spie.org/x14608.xml) in 2007. Other novel devices such as polarizers, phase gratings, Solc birefringent filters have also been demonstrated [OL, to appear 2008, Opt. Exp. 16(5):2995, 2008; OL, to appear 2008].

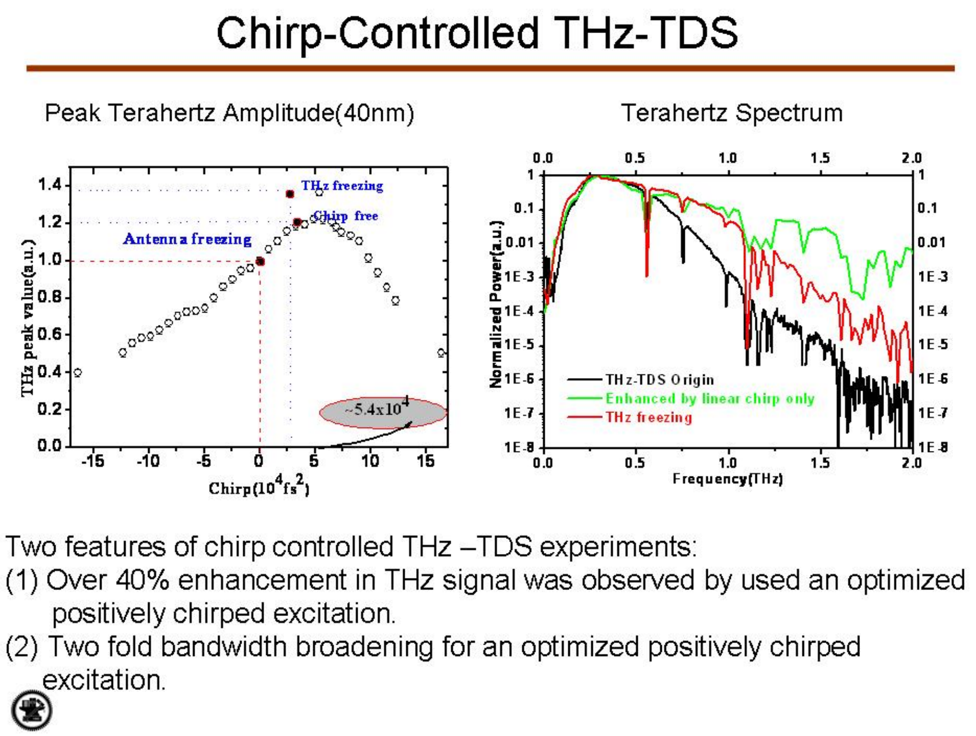


4. Adaptive coherent control: Technology and Applications (Profs. Jung Y. Huang, Chuck Chao-Kuei Lee and Ci-Ling Pan)

A freezing phase concept has been proposed for adaptive coherent control with a femtosecond pulse shaper [*JOSA B* 22:1134 (2005), selected by *the Virtual J. Ultrafast Sci.*, 2005]. The operational principle is based on a concept that the highest peak intensity will correspond to a frozen phase state of all spectral components involved in a coherent optical pulse. It is fast and immune to the noise and laser power fluctuation, and useful for a variety of applications that require complete-field characterization and adaptive coherent control on the same setup. We applied the scheme to investigate multiphoton processes in InAs quantum dot saturable Bragg reflector (SBR, fabricated by Prof. Jen-Inn Chyi, NCU). The optical transition of InAs quantum dots can be revealed in the spectral phase sensitivity plot of second harmonic signal. We also achieved a three-time increase in image contrast on regions with photoluminescent wavelength differing only 18 nm by using coherent control nonlinear optical microscopy.



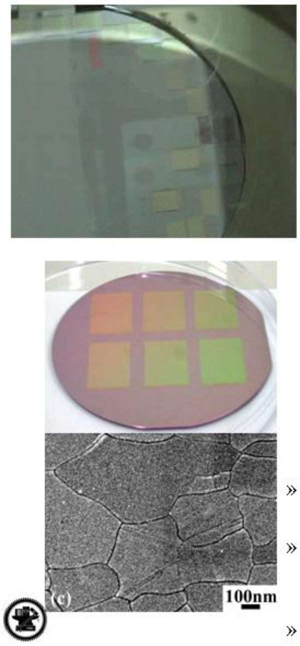
Emplying the freezing phase algorithm, we also investigated the enhancement of broadband THz radiation using femtosecond pulse shaping. Over 60% radiation enhancement in output power and two-fold broadening of bandwidth were found for optimized positively chirped optical pulses. We have tentatively attributed the phenomon to the increasing saturation fluences from competition between band-filling and pump-dump processes during excitation. In addition, pump power dependence of THz radiation and enhancement factor, which is defined as ratio of peak amplitude of the radiated THz pulse before and after adaptive control. With fixed probe beam power while reducing the pump power from 45mW to 5mW, we observed an increase in the enhancement factor from 40% to 60%. A model of enhancement based on higher saturation flurence for positively-chirped optical excitation is proposed. Other factors such as difference in absorption by leading waves in for positive or negative chirped pulse could also contribute to the observed phenomenon [CLEO'08, Opt. Exp., submitted, 2008]. .

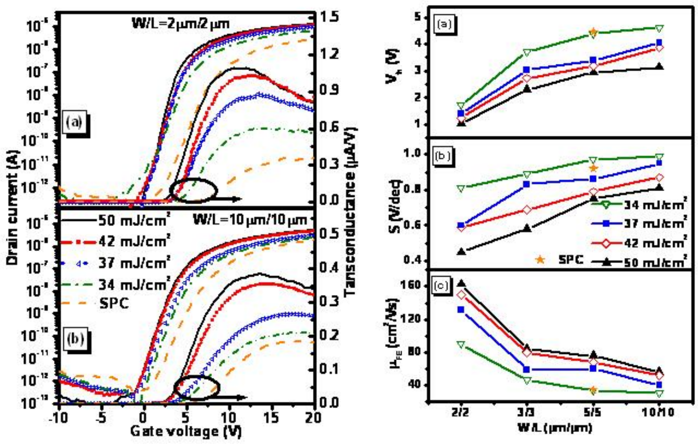


5. Femtosecond LaserAnnealing: A novel approach for dopant profile engineering and fabrication of poly-Si TFT (Prof. Ci-Ling Pan)

Amorphous silicon (a-Si) for TFT applications was crystallized by femtosecond laser annealing (FLA) using a near-infrared (800 nm) ultrafast Ti:sapphire laser system for the first time. We found that FLA assisted by spatial scanning of laser strip spot can crystallize a-Si films with largest grains of ~800 nm, requiring laser fluence as low as ~45 mJ/cm2, and low laser shots. Moreover, the optimal annealing conditions are observed with a significant laser-fluence window (~30%) [reported at CLEO2003 as a news story; APL 85(7):1232, 2004, selected by the Virtual J. Ultrafast Sci., September 2004, ROC patent I245321]. We also demonstrated dopant profile engineering by near-infrared femtosecond laser activation [APL 88:1311104, March 27, 2006, selected by Virtual J. of Nanoscale Sci. and Technology, Vol. 13, No. 14, April 10, 2006 and Virtual Journal of Ultrafast Science, Vol. 5, No. 4, April 2006]. Preamorphizing implantation is not required. We find dopant profiles in FLA-activated samples essentially duplicate those of as-implanted ones even for junctions as deep as 100 nm below the surface. Laser-recrystallized material was used successfully for fabricating thin film transitors [*Opt. Exp., 15: 6981, 2007*, selected by *Virtual J. of Ultrafast Sci., July 2007*]. THz spectroscopic techniques were employed for diagnostics of the fs-laser-annealed poly-Si material [Photonics Asia, invited talk, 2007, Opt. Exp. Submitted, 2008]. It is shown that The transient mobilities of poly-Si with large (~ 500 nm) and small (~ 50 nm) grain sizes, fitted by the Drude model, are 175.0±19.4 cm2/V s and 94.5±20.2 cm2/V s, respectively. We proposed that higher mobility in large-grain poly-Si by femtosecond laser annealing is due to reduction of deep state density rather than tail state density.

Near-infrared femtosecond laser crystallized poly-Si thin film transistors





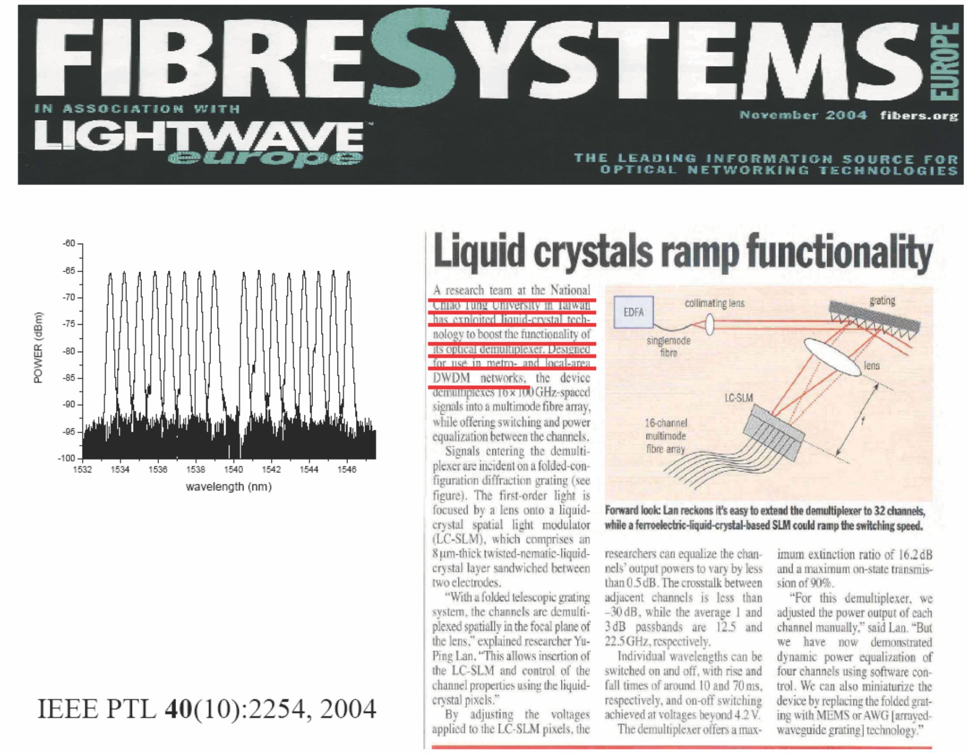
» FLA assisted by spatial scanning of laser strip spot efficiently crystallizes a-Si films with large average grains of 800 nm.

» Field-effect mobility, threshold voltage, and subthreshold slope for FLA-processed transistors are superior to those of SPC-processed while comparable to those of ELA-fabricated transistors.

» A much wider FLA process window than ELA was observed.

6. **Tunable Lasers and Electro-Optic Devices for DWDM and Attosecond Generation with Liquid Crystal (LC) Enabled Functionalities and other applications (Profs. Ci-Ling Pan, Ru-Pin Pan, Andy H. Kung)**:

A digitally tunable laser diode, of which the output can be switched between wavelengths of the ITU grid (100 GHz channel spacing) for DWDM optical communication systems (λ = 1550 nm), is demonstrated [Optics Express, **12** (26):6434, 2004; **invited talk and paper at Photonics West 2002**; **Taiwan Patent I223484, US patent filed**]. Another design allows continuous, mode-hop-free electronic tuning of the laser frequency over 20 GHz [Opt. Eng. **43**(1):234, 2004; OL **29**(5):510, 2004]. Dynamic wavelength switching and selection were achieved with a liquid crystal pixel mirror (LCPM). Fine tuning is achieved through an intra-cavity LC phase shifter. As an application, we recently reported intra-cavity LC cell gap measurement [Opt. Exp. **13**(20):1905, 2005]. This design concept has been extended to devices such as tunable optical switches/ filters/ equalizers/ demultiplexers. Demultiplexing 16-channel 100-GHz -spaced signals into a 62.5-μm multimode-fiber array was demonstrated. The central wavelength of each channel was designed according to the 100-GHz ITU grid. Adjacent channel crosstalk is less than 30 dB. The outputs of the channels are equalized to 65 dBm. The variation between different channels reduced from 10 dB to less than 0.5 dB [IEEE Photon. Technol. Lett., **40**(10):2254, 2004, ROC patent disclosed, 2006]. **This work was reported by Lightwave Europe in the November issue, 2004**. Recently, we report automatic power equalization and stabilization with minimum ripple level of a single channel down to 0.05 dB [Opt. Comm. 278:329, 2007].



Liquid crystals ramp functionality

A research team at the National Chiao Tung University in Taiwan has exploited liquid-crystal technology to boost the functionality of its optical demultiplexer. Designed for use in metro- and local-area DWDM networks, the device demultiplexes 16 × 100 GHz-spaced signals into a multimode fibre array, while offering switching and power equalization between the channels.

Signals entering the demultiplexer are incident on a folded-configuration diffraction grating (see figure). The first-order light is focused by a lens onto a liquid-crystal spatial light modulator (LC-SLM), which comprises an 8 µm-thick twisted-nematic-liquid-crystal layer sandwiched between two electrodes.

"With a folded telescopic grating system, the channels are demultiplexed spatially in the focal plane of the lens," explained researcher Yu-Ping Lan. "This allows insertion of the LC-SLM and control of the channel properties using the liquid-crystal pixels."

By adjusting the voltages applied to the LC-SLM pixels, the researchers can equalize the channels' output powers to vary by less than 0.5 dB. The crosstalk between adjacent channels is less than –30 dB, while the average 1 and 3 dB passbands are 12.5 and 22.5 GHz, respectively.

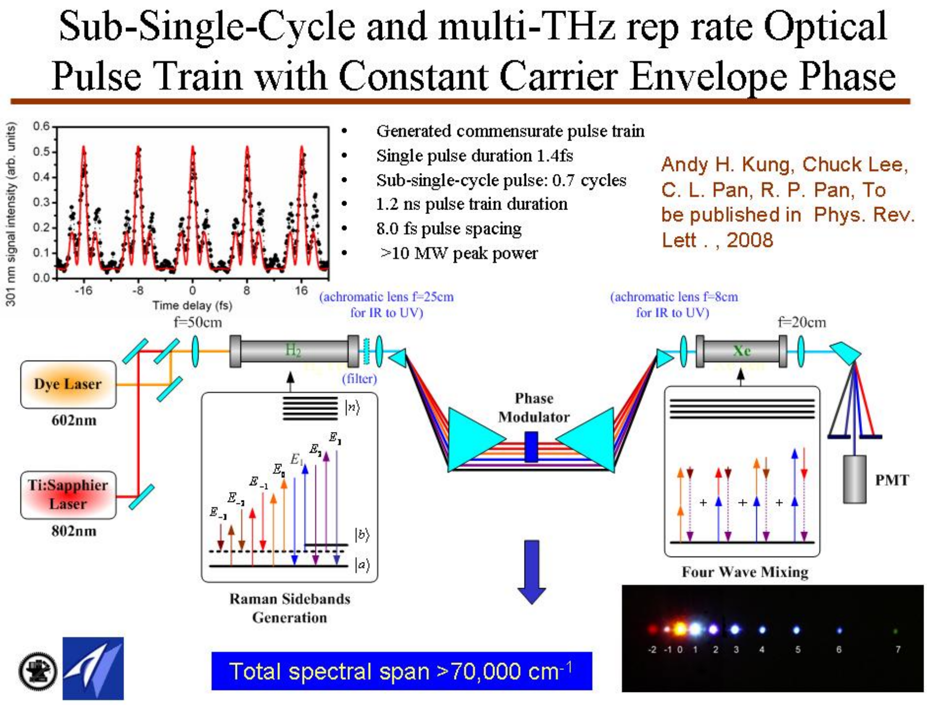
Individual wavelengths can be switched on and off, with rise and fall times of around 10 and 70 ms, respectively, and on-off switching achieved at voltages beyond 4.2 V.

The demultiplexer offers a maximum extinction ratio of 16.2 dB and a maximum on-state transmission of 90%.

"For this demultiplexer, we adjusted the power output of each channel manually," said Lan. "But we have now demonstrated dynamic power equalization of four channels using software control. We can also miniaturize the device by replacing the folded grating with MEMS or AWG [arrayed-waveguide grating] technology."

Forward look: Lan reckons it's easy to extend the demultiplexer to 32 channels, while a ferroelectric-liquid-crystal-based SLM could ramp the switching speed.

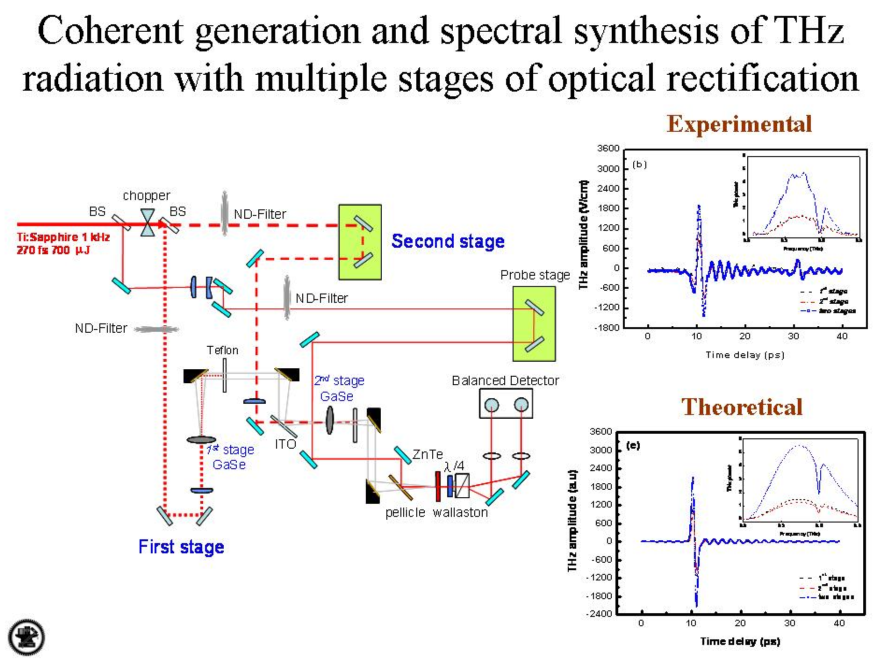
A specially designed SLM was developed and used in frequency synthesis of attosecond pulses, in collaboration with Prof. Andy H. Kung [*Phys. Rev. Lett*. 100: 163906, 2008]. Using 7 Raman sidebands generated by molecular modulation in H_2, we achievd the synthesis of periodic waveforms consisting of a train of pulses that are 0.83 cycles long and have an electric field pulse width of 0.44 fs.



The SLM composed of a row of five 14 mm high by 4 mm wide by 0.022 mm thick liquid-crystal panels. The size and location of each panel is designed to match the sideband beam size and to allow unimpeded passage of five sidebands. With this new modulator, a total of 7 sidebands can now be employed for waveform synthesis. The total bandwidth is 24931.2 cm^{-1} or 2 octaves. We verify by optical correlation that the carrier-envelope phase is constant in these waveforms when they are synthesized from commensurate sidebands. The estimated overall shift of the carrier-envelope phase is less than 0.18 cycles from the first to the last pulse of nearly 10^6 pulses in the pulse train.

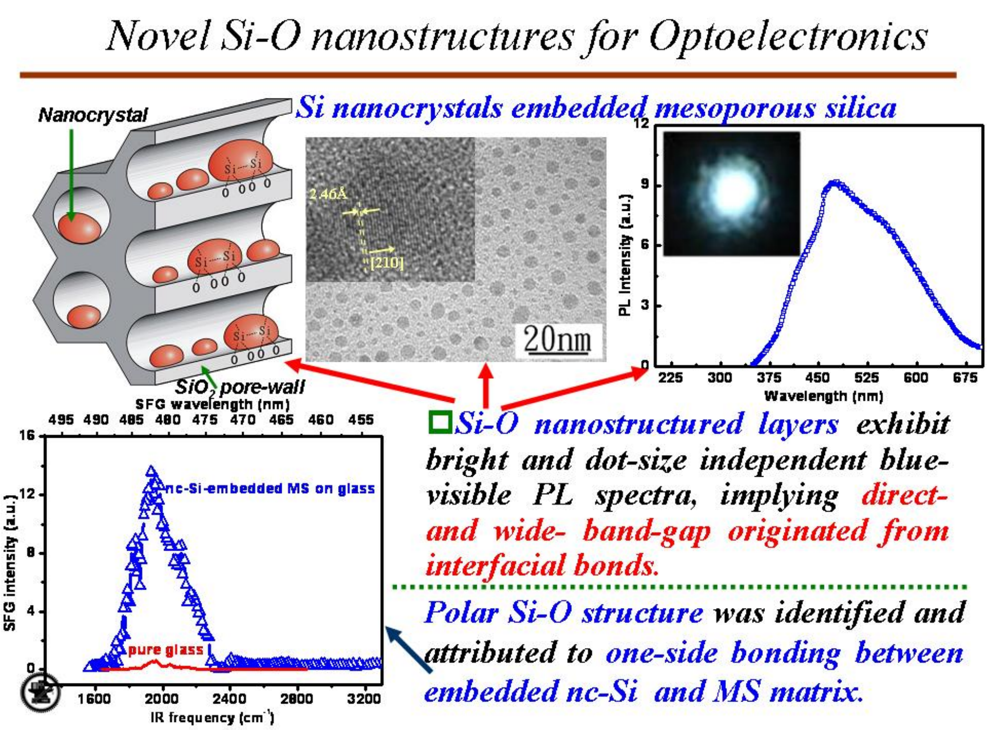
7. Generation of coherent mid- and far- infrared radiation in GaSe (Profs. Ci-Ling Pan and Jung Y. Huang)

A table-top infrared light source with high intensity and wide tunability is constructed by use of difference-frequency-mixing in GaSe nonlinear optical crystal. Tuning wavelengths from 2.4μm to 28μm are obtained with highest energy output ~13μJ at 3.5μm. The output characteristics are compared among pure and erbium doped crystals. Second-order nonlinear coefficient $d_{eff}^{(2)}$ of the Er:GaSe crystals reveal a $d_{eff}^{(2)}$ of 55.3 pm/V, which is about 24% larger than that of pure GaSe. The improvement of $d_{eff}^{(2)}$ can be attributed to the substitutive and interstitial doping of Er ion in GaSe unit cell. [*Opt. Exp.* 14:5484, 2006, selected by *Virtual J. of Ultrafast Sci., August 2006) and Virtual J. of Biomed. Opt.*]. We also report a study of the effect of optical absorption on generation of coherent infrared radiation from mid-IR to THz region from GaSe crystal. The infrared-active modes of ε-GaSe crystal at 236 cm^{-1} and 214 cm^{-1} were found to be responsible for the observed optical dispersion and infrared absorption edge. Based upon phase matching characteristics of GaSe for difference-frequency generation (DFG), new Sellmeier equations of GaSe were proposed. The output THz power variation with wavelength can be properly explained with a decrease of parametric gain and the spectral profile of absorption coefficient of GaSe. The adverse effect of infrared absorption on (DFG) process can partially be compensated by doping GaSe crystal with erbium ions. [*Opt. Exp.* 14:10636, 2006, selected by *Virtual J. of Ultrafast Sci.*, January 2007, listed in *Virtual J. of THz Sci. and Technol.*, October 2006]. Recently, we proposed and demonstrated coherent generation and spectral synthesis of terahertz radiation with multiple stages of optical rectification [Opt. Exp., submitted, 2008]. This approach can potentially be useful for the generation of single-cycle high-amplitude terahertz pulses, which is currently limited by the pulse walk-off effect from group velocity mismatch.

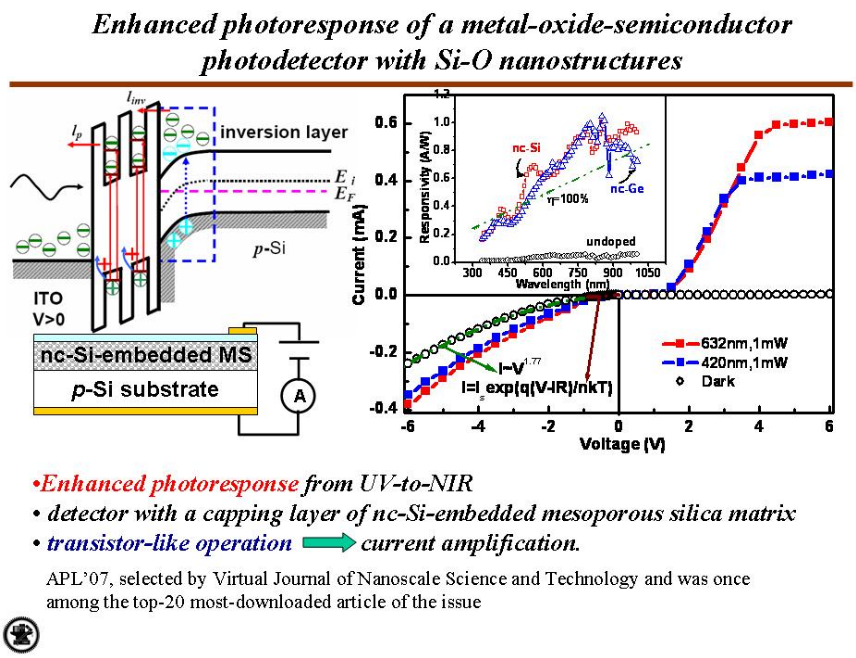


8. Nonlinear optical studies of Silicon nanocrystals and Nano-Silicon-based optoelectronics (Profs. Jung Y. Huang, Ci-Ling Pan, and Dr. Jia-Min Shieh)

A novel material of Si nanocrystals embedded in a three-dimensional array of mesoporous silica matrix has been studied by nonlinear optical techniques. We report sum-frequency generation spectroscopic studies of Si-O polar nanostructures embedded in a three dimensional array of mesoporous silica (MS) matrix by use of different frequency combinations with picosecond and femtosecond configurations. Such unique electronic structure of Si nanocrystals (nc-Si) embedded in SiO_2 is opening up wide applications to flash memory and photonic devices. The effective second-order nonlinear coefficient and Curie temperature of nc-Si are determined by surface sum frequency generation spectroscopy. A resonance feature around 480 nm was observed. The effective second-order nonlinear coefficient is estimated to be d_{eff} =3.7 pm/V. Nonlinearity is tentatively attributed to Si-O nanostructures in this novel material. The effect of heating and cooling cycle on SFG signals provides evidence of ferroelectricity for nc-Si embedded mesoporous silica. The Curie temperature of the material is estimated to be 567K.



A two-terminal metal-oxide-semiconductor photodetector for which light is absorbed in the nano-Si material described above as a capping layer on p-type silicon substrates was fabricated. Operated at reverse bias, enhanced photoresponse from 300 to 700 nm was observed. The highest optoelectronic conversion efficiency is as high as 200%. The enhancements were explained by a transistorlike mechanism, in which the inversion layer acts as the emitter and trapped positive charges in the mesoporous dielectric layer assist carrier injection from the inversion layer to the contact, such that the primary photocurrent could be amplified [APL 90: 051105 2007, selected by *Virtural J. Nanoscale Sci. & Technol.2007*]. This paper was at one time among the top 20 most downloaded papers for the APL issue..



9. Femtosecond Fiber Lasers and Applications (Profs. Gong-Ru Lin and Ci-Ling Pan)

9-1 Self-Steepening of Prechirped Amplified and Compressed 29-fs Fiber Laser Pulse in Large-Mode-Area Erbium-Doped Fiber Amplifier

Prechirped amplification, soliton compression, and self-pulse-steepening of a 300-fs stretch-pulse mode-locked erbium-doped fiber laser (EDFL) pulse in an ultrashort length large-mode-area erbium-doped fiber amplifier (LMA-EDFA) and large-effect-area fiber (LEAF) link are investigated. *In situ* amplified compression of the single-mode-fiber prechirped EDFL pulse (broadened to 1.2 ps) is initiated in the LMA-EDFA at a pumping power of > 160 mW, which provides a 20-fold pulsewidth compressing ratio for the incoming EDFL pulse and supports a maximum output power of > 20 dBm. With an extremely short LEAF-based fifth-order soliton stage, the amplified EDFL pulse can further be compressed down to a pulsewidth of 29 fs, which gives rise to a total pulsewidth-compressing ratio of as high as 40. The LMA-EDFA-based prechirped and amplified soliton compression leaves a small pedestal on the EDFL pulse with an energy confinement ratio of 74%, providing a 20-dB magnified pulse energy of 2.3 nJ and a 10-dB spectral linewidth of 150 nm. The self-steepening-induced blue-side spectral stretch by 1.3 THz is elucidated.

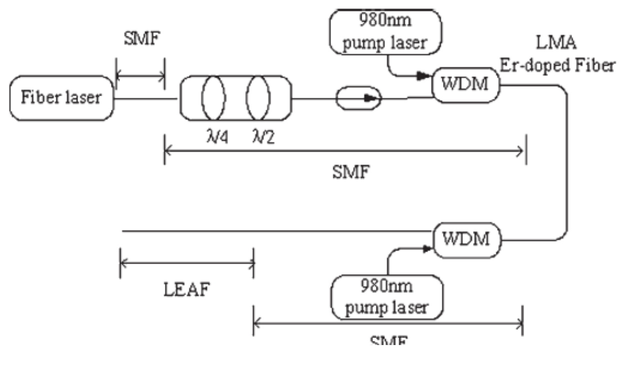


Fig. 1. Experimental setup of an LMA-EDFA + LEAF amplified compressor link.

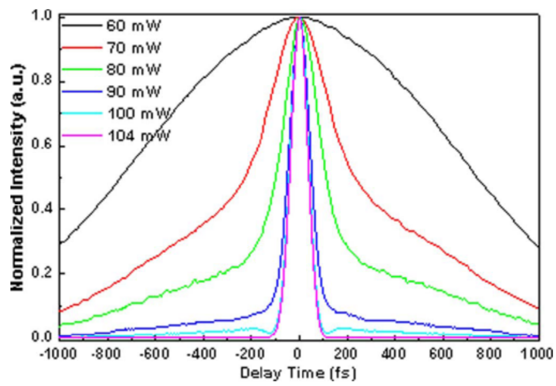


Fig. 2. Autocorrelation traces of the *in situ* amplified and compressed APM-EDFL pulses measured at different LMA-EDFA output powers.

9-2 Dynamic chirp control of all-optical format-converted pulsed data from a multi-wavelength inverse-optical-comb injected semiconductor optical amplifier

By spectrally and temporally reshaping the gain-window of a traveling-wave semiconductor optical amplifier (TWSOA) with a backward injected multi- or single-wavelength inverse-optical-comb, we theoretically and experimentally investigate the dynamic frequency chirp of the all-optical 10GBit/s Return-to-Zero (RZ) data-stream format-converted from the TWSOA under strong cross-gain depletion scheme. The multi-wavelength inverse-optical-comb injection effectively depletes the TWSOA gain spectrally and temporally, remaining a narrow gain-window and a reduced spectral linewidth and provide a converted RZ data with a smaller peak-to-peak frequency chirp of 6.7 GHz. Even at high inverse-optical-comb injection power and highly biased current condition for improving the operational bit-rate, the chirp of the multi-wavelength-injection converted RZ pulse is still 2.1-GHz smaller than
that obtained by using single-wavelength injection at a cost of slight pulsewidth broadening by 1 ps.

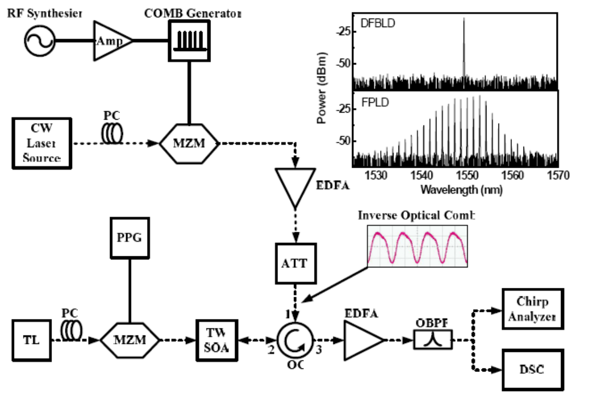


Fig. 3. Experimental setup. Amp.: amplifier.; ATT.: optical attenuator; DSO: digital sampling oscilloscope; EDFA: erbium doped fibre amplifier; OBPF: optical band-pass filter; OC: optical circulator; PC: polarization controller; PPG: PRBS pattern generator; TL: tunable laser. Electrical path: solid line. Optical path: dash line.

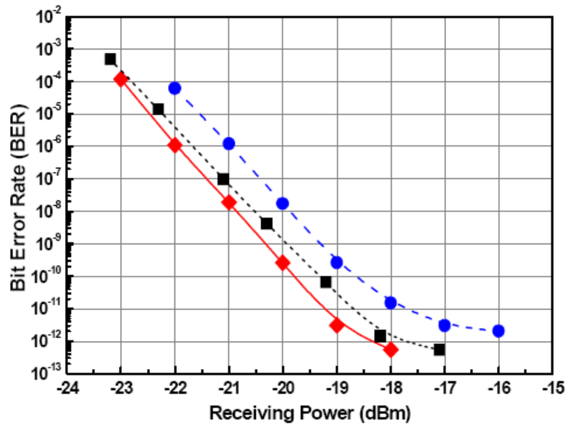


Fig. 4. BER performance of the back-to-back NRZ (blue circle) and the TWSOA converted RZ under DFBLD (black square) and FPLD (red diamond) based inverse-optical-comb injection.

9-3 All-Optical Decision-Gating of 10-Gb/s RZ Data in a Semiconductor Optical Amplifier Temporally Gain-Shaped With Dark-Optical-Comb

We demonstrate a novel all-optical noninverted OC-192 return-to-zero (RZ) decision-gate by using a semiconductor optical amplifier (SOA) which is gain-controlled to achieve an extremely high cross-gain-modulation depth and a narrow gain window. A dark-optical-comb generated by reshaping the optical clock RZ data in a Mach–Zehnder intensity modulator is employed as an injecting source to temporally deplete most of the gain in the SOA. Such a dark-optical-comb injected SOA decision-gate exhibits improved 3R regeneration performances such as a timing tolerance of 33.5 ps, a *Q*-factor of 8.1, an input dynamical tolerance of 14 dB, and an extinction ratio (ER) of 14 dB. The deviation between the wavelengths of backward injected dark-optical-comb and input RZ data for optimizing the ER of the decision-gate is determined as $\Delta\lambda$ = 19 nm. Under a threshold operating dark-optical-comb power of 7 dBm, such a decision-gate can recover the −18.5-dBm degraded RZ data with a bit-error-rate of less than 10−9 at 10 Gb/s. A negative power penalty of −4.2 dB is demonstrated for the RZ data after 50-km propagation and decision gating.

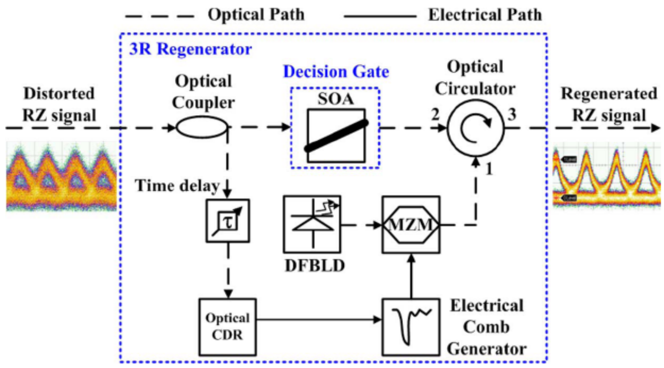


Fig. 5. Schematic diagram of the backward optical-comb injection SOA-based decision-gate.

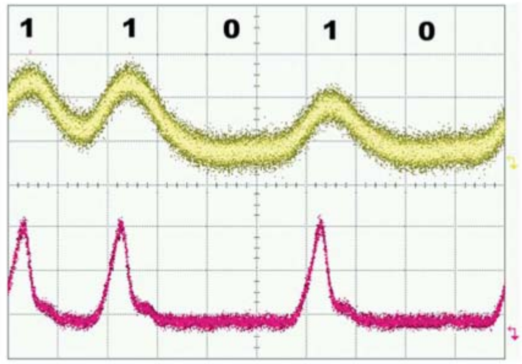


Fig. 6. (Top) Distorted RZ data-stream with “11010” pattern at 10 Gb/s.(Bottom) Converted data stream.

9-4 Simultaneous pulse amplification and compression in all-fiber-integrated pre-chirped large-mode-area Er-doped fiber amplifier

A large-mode-area Erbium-doped fiber amplifier (LMA-EDFA) based all-fiber-integrated amplified compressor with ultrashort length of 5.37 m and ultralow pumping power (260 mW) is proposed. The LMAEDFA suppresses nonlinear soliton-self-frequency-shift effect happened during femtosecond pulse amplification, in which the fiber laser pulse is reshaped to a low-pedestal hyperbolic-second shape with nearly 100% energy confinement. The pre-chirped amplification from 0.96 to 104 mW and the simultaneous compression of a passively mode-locked fiber laser pulse from 300 to 56 fs is demonstrated. The input pulse energy of 24 pJ is amplified up to 2.6 nJ with shortened pulsewidth of 56 fs and peak power as high as 46 kW.

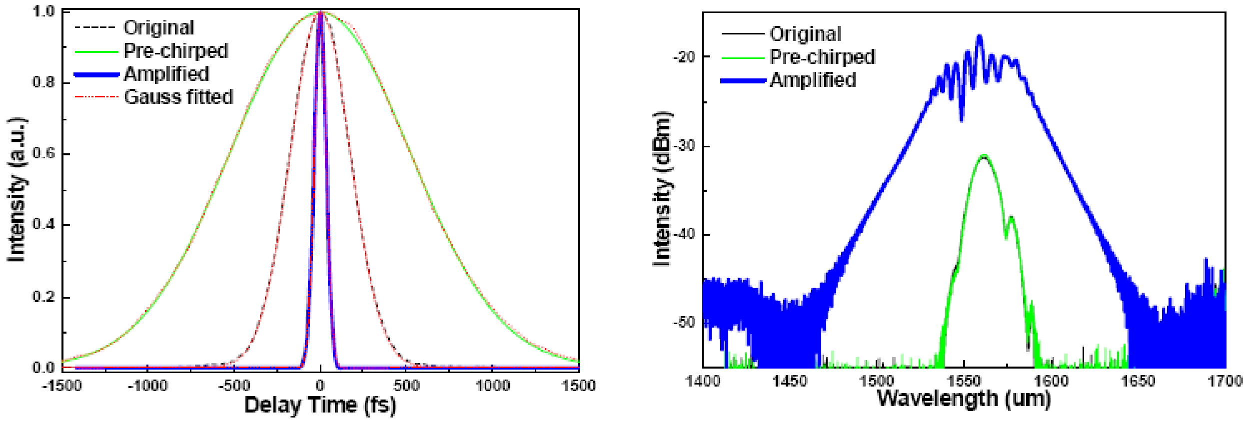


Fig. 7. Autocorrelation traces (left) and corresponding pulse spectra (right) of the original, the pre-chirped and the amplified/compressed pulses.

9-5 Femtosecond mode-locked Erbium-doped fiber ring laser with intra-cavity loss controlled full L-band wavelength tunability

By using a tunable-ratio optical coupler (TROC) to adjust the wavelength dependent intra-cavity loss, a L-band mode-locked erbium-doped fiber-ring laser (ML-EDFL) is demonstrated for generating wavelength-tunable femtosecond pulses. The change of output coupling ratio introduces different intra-cavity loss and shifts the peak of mode-locked gain profile to provide continuous detuning on wavelength of the ML-EDFL. A maximum tuning range of about 40 nm (from 1565.1 to 1605.3 nm) by decreasing the output coupling ratio from 95% to 5% is obtained, corresponding to a wavelength tuning slope of 2.25 nm/dB. The ML-EDFL exhibits a super-mode suppressing ratio as high as 47 dB and a pulsewidth of <5 ps at repetition frequency of 1 GHz. Nearly transform-limited pulsewidth of 580 fs is generated by linear dispersion compressing the

EDFL pulses with a 32.5m-long single-mode fiber under an output coupling ratio of 10%.

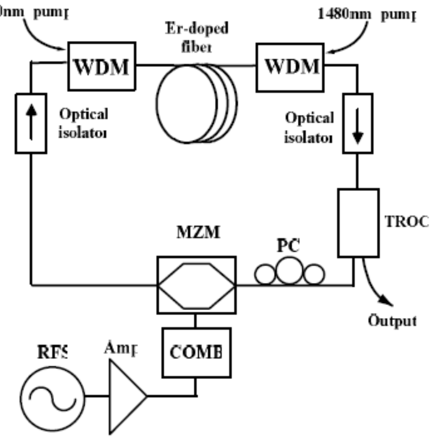


Fig. 8. Schematic diagram of the mode-locked EDFL with a TROC-based wavelength tuning configuration. Amp: microwave amplifier; COMB: electrical comb generator; MZM: Mach-Zehnder modulator; PC: polarization controller; RFS: radio-frequency synthesizer; TROC: tunable-ration optical coupler; WDM: wavelength division multiplexing coupler.

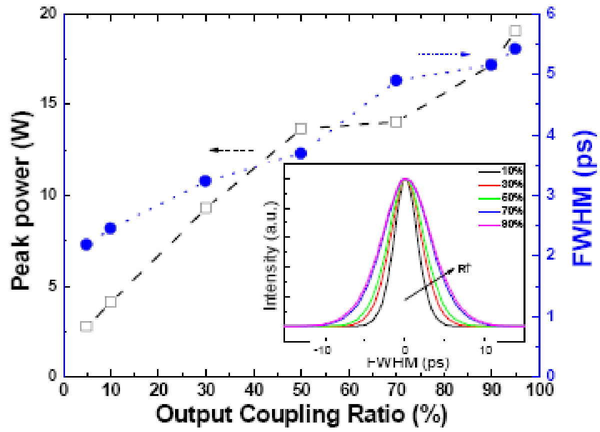


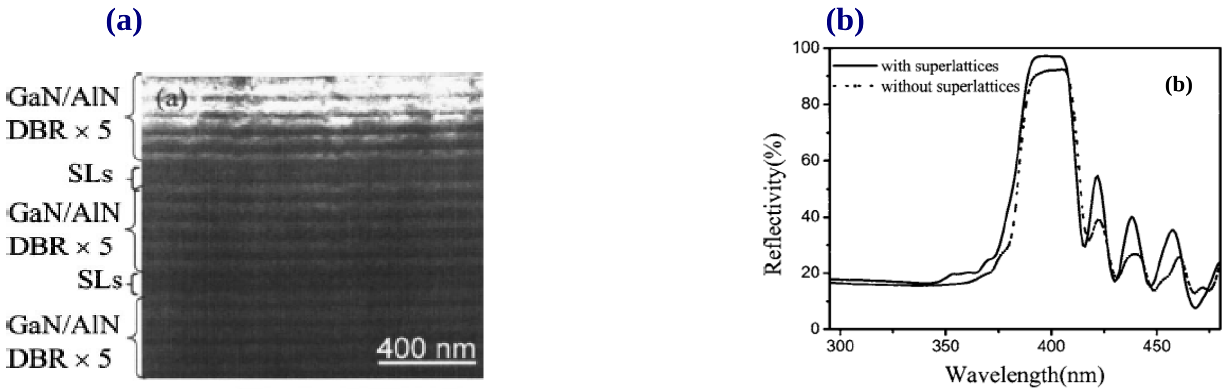
Fig. 9. The peak power and the pulsewidth of the pulses as the output coupling ratio adjust from 10% to 90%. Inset: The autocorrelation traces of the output pulses.

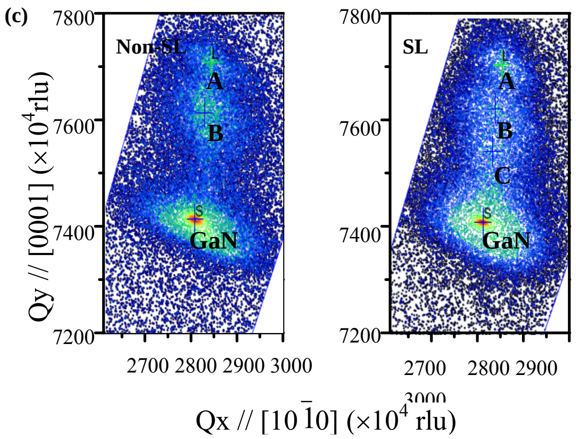
10. GaN-based Vertical Cavity Surface Emitting Laser and Light Emitting Diodes （Prof. Hao-Chung Kuo and Tien-Chang Lu）

10-1. Study of high reflectivity mirror for blue high quality light emitter

In this part, we develop the high reflectivity epitaxially grown nitride mirror, usually in the form of distributed Bragg reflector (DBR), using MOCVD epitaxy technique. The nitride material system usually has a serious strain problem for the epitaxy of such multi-film structure. Therefore, the fabrication of high reflectivity mirror for blue light emitter is a difficult topic. In this study, we have developed a solution for the epitaxy of high-reflectivity reflector.

A crack-free GaN/AlN DBR incorporated with GaN/AlN superlattice (SL) layers was successfully grown on a c-plane sapphire substrate (Figure 1(a)). We inserted three sets of half-wave layers consisting of 5.5 periods of GaN/AlN SL layers and GaN layer in every five pairs of the 20 pair GaN/AlN DBR structure to suppress the crack generation. The grown GaN/AlN DBRs with SL insertion layers showed no observable cracks in the structure and achieved high peak reflectivity of 97% at 399 nm with a stop band width of 14 nm(Figure 1(b)). Based on the x-ray analysis (Figure 1(c)), the reduction in the in-plane tensile stress in the DBR structure with insertion of SL layers could be responsible for the suppression of crack formation and achievement of high reflectivity.



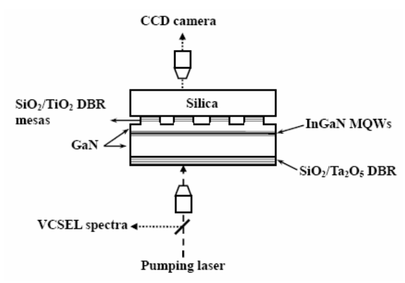


(c)

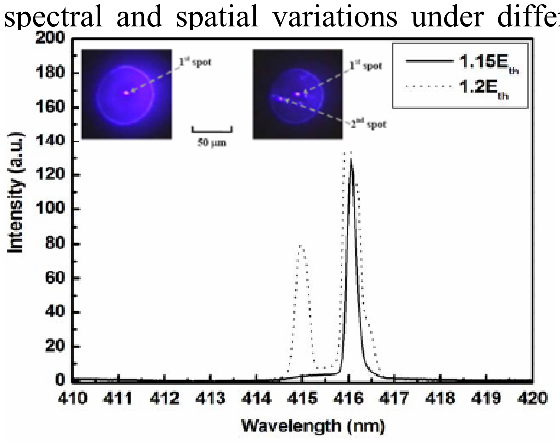
Figure 1 (a) The TEM image of GaN/AlN DBR; (b) The reflectivity spectrum of DBRs with and without superlattice; (c) the Reciprocal space maps of non-SL and SL samples.

10-2. Emission characteristics of optically pumped GaN-based vertical-cavity surface-emitting lasers

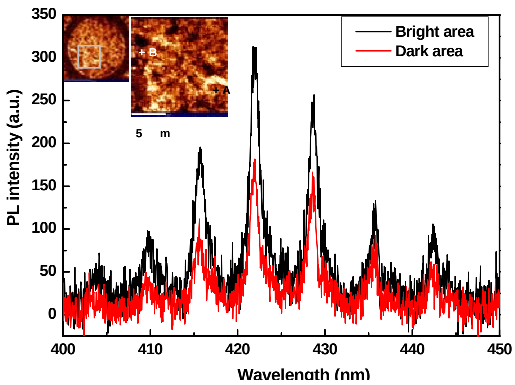
The laser emission characteristics of a GaN-based vertical-cavity surface-emitting laser with two dielectric distributed Bragg reflectors were investigated under optically pumped operation at room temperature. The laser emitted wavelength at 415.9 nm with an emission linewidth of 0.25 nm and threshold pumping energy of 270 nJ. The laser has a high characteristic temperature of about 278 K and high spontaneous emission coupling factor of 10−2. The laser emission showed single and multiple spot emission patterns with spectral and spatial variations under different pumping conditions.



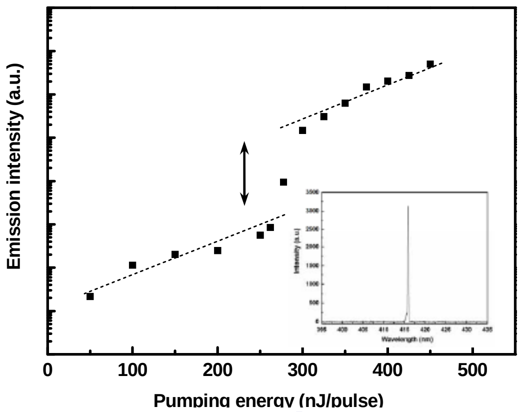
(a)



(b)



(c)



(d)

Figure 2 (a) Schematic setup of pumping and μ-PL scanning. (b) Emission pattern of the VCSEL at pumping energy of 1.15 Eth with single laser emission spot and 1.12 Eth with two laser spots. The arrows indicate the position of the first and second emission spots. Emission spectrum at pumping energy of 1.15 Eth and 1.12 Eth, respectively. (c) PL spectra of bright (point A) and dark (point B) areas. (d) Laser emission intensity versus pumping energy in semilogarithmic scale. The b value estimated from the difference between the two dash lines is about 2x10-2. The inset shoes he spectrum of the laser emission with a wavelength of 415.9nm.

10-3. Study of characteristics of GaN vertical cavity surface emitting laser (VCSEL)

Following the success of laser action of GaN VCSEL using optical pumping, we further investigated the characteristics and performance of GaN blue VCSEL. The structure of GaN VCSEL is formed by a 3λ cavity sandwiched by a 25 pairs AlN/GaN distributed Bragg reflector (DBR) and an eight pairs Ta2O5–SiO2 DBR (Figure 3(a)). The pumping condition could be monitored by a CCD. The near field image was shown in figure 3(b) and laser occurred in the form of spot emission at the center of pumping area. The GaN VCSEL emits a blue wavelength at 448 nm with a linewidth of 0.17 nm (Figure 3(c)) with a near-field emission spot diameter of about 3μm. The laser beam has a near linear polarization with a degree of polarization of about 84%. The laser shows a high spontaneous emission coupling efficiency (β) of about 5×10-2 (Figure 3(d)) and a high characteristic temperature of about 244 K. The high beta value also implies the thresholdless laser for the nitride material system is highly possible.

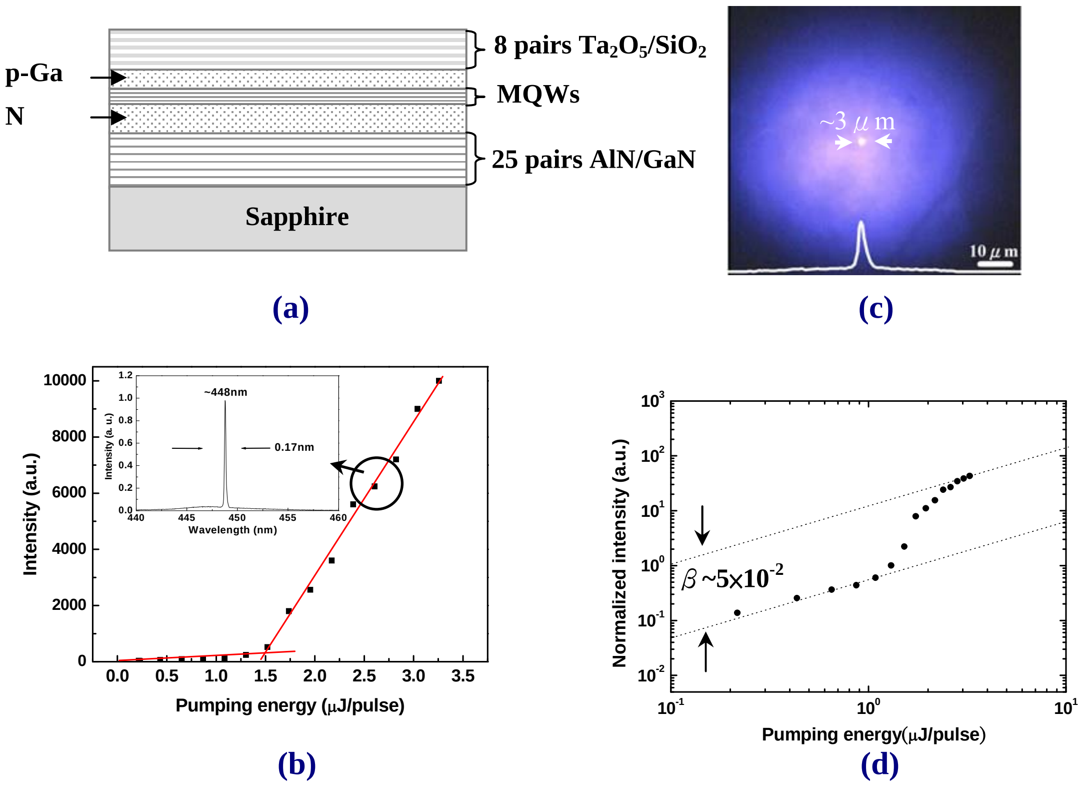
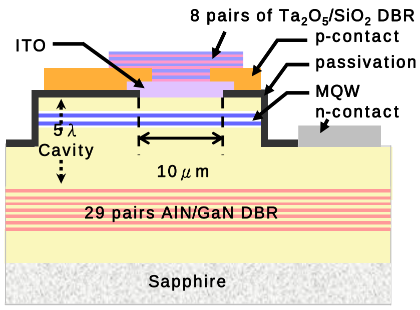


Figure 3 (a) The schematic diagram, (b) The near field image, (c) The threshold characteristics, and (d) The beta performance of of GaN VCSEL under optical pumping

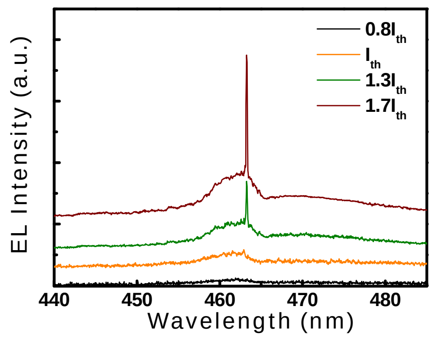
10-4 Successfully fabricated low-temperature electrical pumping InGaN-MQW VCSELs by hybrid mirrors

The GaN-based VCSEL structure was grown by MOCVD (EMCORE D-75). We use the polished *c*-face (0001) 2-inch-diameter sapphire as a substrate for the epitaxial growth. The VCSEL structure composed of a 5λ cavity, a 29 pairs AlN/GaN DBR as bottom mirror and an eight pairs Ta_2O_5/SiO_2 dielectric mirror as the top DBR reflector. By using lithograph technology, etching by RIE and deposed contact metals on the substrate, we can successfully fabricate low-temperature electrical pumping InGaN-MQW VCSELs by hybrid mirrors. The schematic diagram of the full structure is shown in figure 4(a).

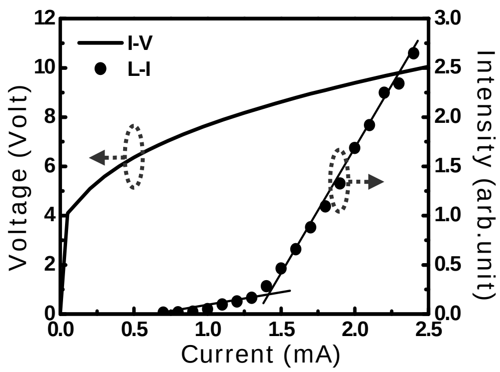
Figure 4(b) shows the photoluminescence emission intensity as a function of wavelength at low temperature condition (77K). From the PL spectrum, we can find the center wavelength at 465nm and a distinct narrow linewidth of the peak nearluy 5.2Å which can be calculated the cavity quality factor (Q) about 894. Figure 4(c) shows the variation of injection current with the voltage and pumping energy.



(a)



(b)



(c)

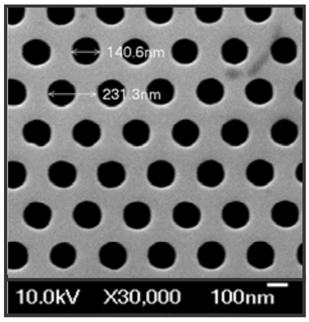
Fig. 4(a). The schematic diagram of the electrical pumping VCSEL structure. (b) The PL spectrum of the structure has the center wavelength 465nm and a narrow linewidth 5.2A. (c) LIV curves of the VCSEL structure has lower turn-on voltages 3.4V.

10-5 Successfully achieved the Lasing Action of GaN-based Two Dimensional Surface-emitting Photonic Crystal Laser

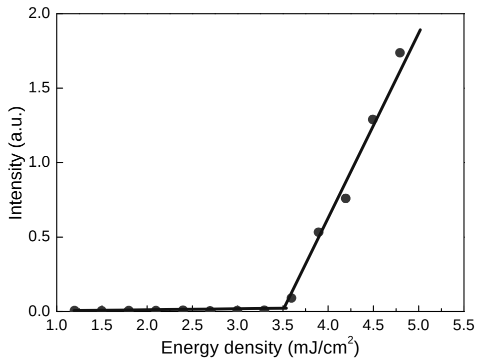
The nitride heterostructure in this experiment was grown by the metal-organic chemical vapor deposition (MOCVD) system on sapphire substrate. The epitaxial structure consists of a 25 pairs AlN/GaN DBR and a 5λ cavity. The 2D PCSEL was fabricated by following steps. First, 200 nm Si3N4 film was deposited as a hard mask using PECVD and spun PMMA by spinner which was patterned using an e-beam lithography. The lattice constants of PCs were in the range between 180 nm and 300 nm. The diameter of each device was 50 μm. Second, the sample was performed a dry etching in an ICP-RIE system to etch GaN as deep as 400 nm. Finally, the sample was dipped in BOE to remove the hard mask to complete 2D PCSEL. Figure 5(a) and (b) show the schematic diagram of our 2D PCSEL, and the SEM image of fabricated 2D PCSEL in top view, respectively.

The threshold characteristics of PCSEL were also measured. Taking one of them for example (*a* = 290 nm), the laser emission intensity from the PCSEL as a function of the exciting energy density is shown in figure 5(c). The threshold energy density (E_{th}) was observed to be around 3.5 mJ/cm^2. The light intensity increased rapidly and linearly as the excitation energy density was above the threshold. Figure 5(d) shows the lasing spectra at different pumping energy. A sharp and narrow laser emission was then clearly observed as the pumping energy increased above the threshold energy. The lasing wavelength located at 424.3 nm, and the FWHM of the laser is around 0.11 nm. Other devices also could be observed the lasing actions occur at the similar threshold energy but different lasing
wavelength.

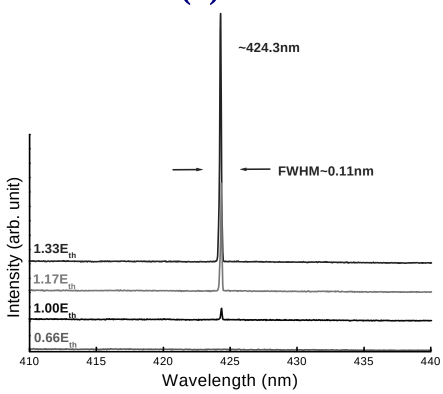
(a)



(b)



(c)



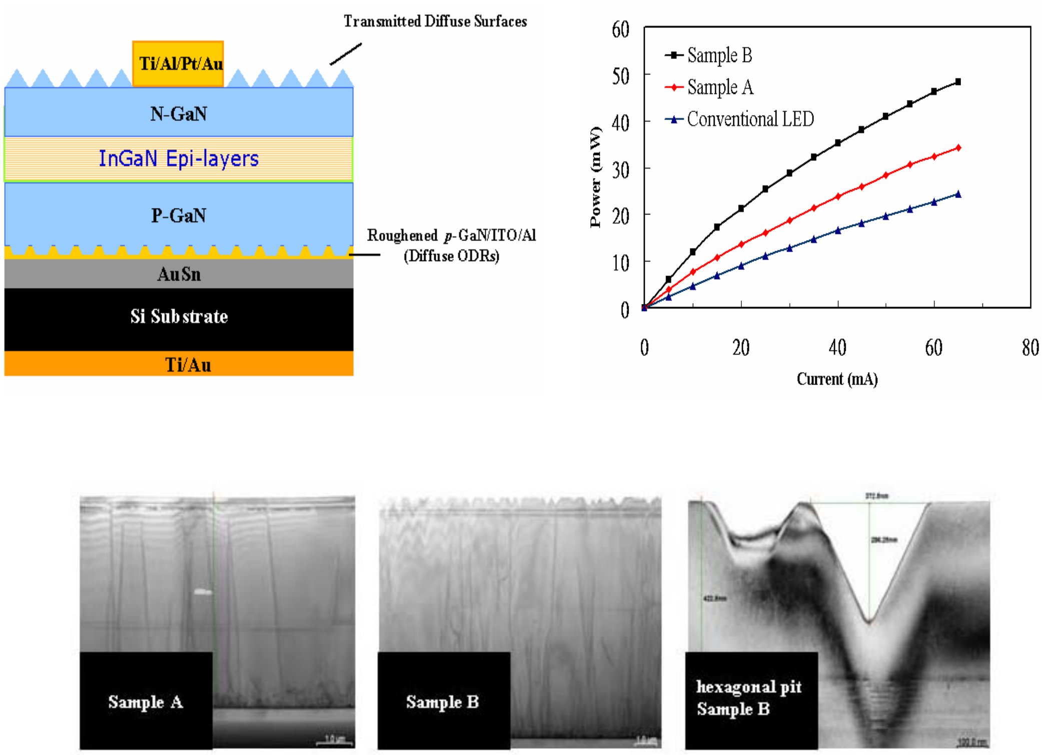
(d)

Figure 5 (a) The schematic diagram of the overall photonic crystal surface emitting laser structure. (b) The SEM image of the full structure in top view. (c) The light output intensity as a function of the pumping energy density at room temperature. The threshold energy density was about 3.5 mJ/cm^2. (d) The variation of the laser emission spectrum with increasing the pumping energy. The laser emission wavelength is 424.3nm with a linewidth of about 0.11nm

10-6. High Light-Extraction GaN-based Vertical LEDs With Double Diffuse Surfaces

We have demonstrated the high light-extraction (external quantum efficiency ~40%) 465-nm GaN-based vertical light-emitting diodes (LEDs) employing double diffuse surfaces. The high scattering efficiency of double diffused surfaces could be responsible for the high light output power. A schematic cross-section image of a GaN-based LED with double diffuse surfaces is shown in Figure 6(a) and (b) shows the light output power (L-I curve) of sample A, sample B and conventional LEDs. The sample B, the LED with double diffuse surfaces, and sample A, the LED with flat omnidirectional reflectors, produced much higher light output as compared with that of conventional LEDs under all our measurement condition. The calculated external quantum efficiency of our proposal LEDs with double diffuse surfaces is about 40% at 20mA (λ~465 nm), which could compete with structures of state of the art.

Figure 6 (c) and (d) shows the cross-sectional transmission electron microscope (TEM) images of sample A and sample B, respectively. In Fig. 6(c), the top surface of p-type GaN was quite flat, as can be seen in conventional LEDs; however, lots of hexagonal V-shape pits was observed on p-type GaN surface of sample B, as shown in Fig. 6(d). Fig. 6(e) is an enlarged TEM image of one hexagonal V-shape pit. As can be seen in this figure, the hexagonal V-shape pit originated from threading dislocations and there is a thick dark band along the V-groove, being indicative of thickness variation.



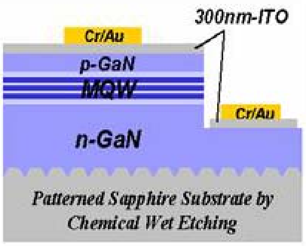
(c) (d) (e)

Figure 6 (a) Schematic cross section of a GaN-based LED with double diffuse surfaces. (b) Output power of sample A, sample B, and conventional LEDs measured by an integral-sphere as a function of a forward current. Cross-sectional transmission electron microscope (TEM) images of (c) flat *p*-GaN surface (sample A) and (d) hexagonal V-shape roughened *p*-GaN surface (sample B). (e) is an enlarged TEM image of one hexagonal V-shape pit.

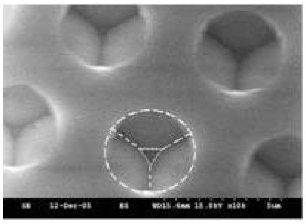
10 -7. Fabrication and Characterization of GaN-based LEDs Grown on Chemical Wet-etched Patterned Sapphire Substrates (CWE-PSS)

Characteristics of GaN-based LEDs grown on patterned sapphire substrate fabricated by the chemical wet etching were specifically analyzed. By chemical wet etching, the sapphire substrate exhibited a particular crystallography-etched facet of {1-102} R-plane with an inclined slope as large as 57o, facilitating a significant enhancement of the light extraction efficiency. An improvement of epitaxial quality was also achieved on CWE-PSS LEDs, according to device reliability testing results.

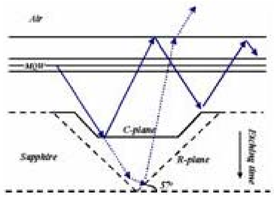
Fig. 7(a) schematically depicts the GaN-based LED grown on the CWE-PSS and the corresponding SEM micrograph of LED full structure is presented in Fig. 7(b). For fabricating the CWE-PSS, the SiO2 film with hole-patterns of 3-μm-diameter and 3-μm-spacing was deposited onto the sapphire substrate to serve as wet etching masks. The sapphire substrate was then wet etched using an H3PO4-based solution at an etching temperature of 300 oC. Fig.7 (c) and (d) show top and cross-section side views SEM images of the pattern sapphire substrate of etching time of 90s Fig.7 (e) and (f) show the evolution of CWE-PSS with the increase of sapphire etching time. With the increasing of the etching time, the total area of C-plane will decrease due to its relative faster etching rate than R-plane. Fig.7 (g) shows the measurement results of output power (L-I curves) of CWE-PSS LEDs with different sapphire etching times. According to this figure, the optimized CWE-PSS condition was achieved on the etching time of 90s, corresponding to an enhanced factor of 1.4. Better reliability characteristics were also observed on the CWE-PSS LEDs, as shown in Fig.7 (h).



(a)

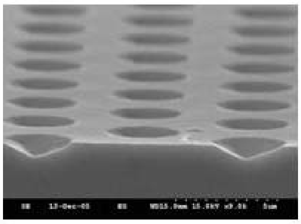


(b)

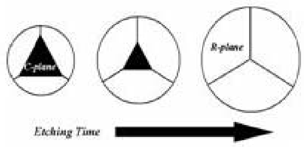


(c)

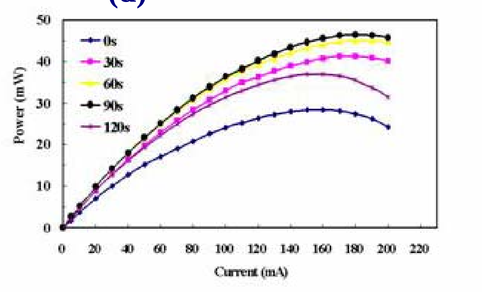
(d)



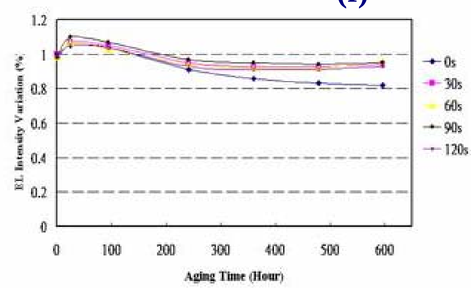
(e)



(f)



(g)



(h)

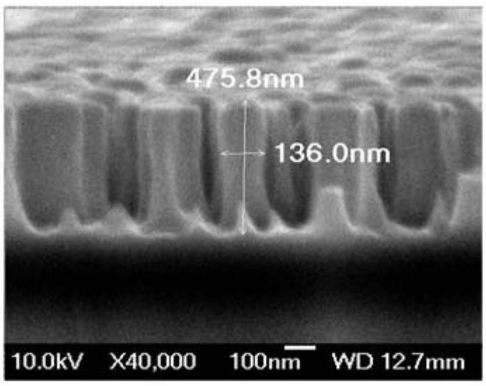
Figure 7 (a) The schematic drawing of the device structure. (b) Cross- sectional side-view SEM images of the CWE-PSS LEDs Structure. (c)(d) The SEM images of the top and cross-section side views. (e)A top-view drawing depicts the evolution of the increasing etching time. (f)A schematic ray-tracing with increasing sapphire etching time.

(g) Output power measurement and CWE-PSS LEDs. (h) Reliability test of the conventional and CWE-PSS LEDs under stress condition of 55℃ and 50 mA.

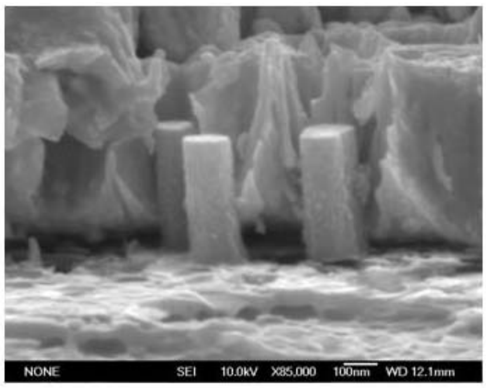
10-8. Fabrication of InGaN/GaN MQW Nanorods LED by ICP-RIE and PEC Oxidation Process with Self-Assembly Ni Metal Islands

We successful fabricated the InGaN/GaN MQW nanorods LED using Ni nano-masks, ICP-RIE etching and PEC oxidation process. The PEC oxidation process can produces better oxidation layer surrounding nanorod to isolate nanorods to electric pumping. A transparent contact layer was deposited to form a connection with the exposed p-type of individual nanorod. We estimate the mean dimension and density of the InGaN/GaN MQW nanorods LED as shown in Fig. 8(a) which shows the SEM images of InGaN/GaN MQW nanorods LED after ICP-RIE etching. The SEM image of in Fig. 8(b) shows the Ni/Au contact metal deposited on InGaN/GaN MQW nanorods LED after PEC oxidation process.

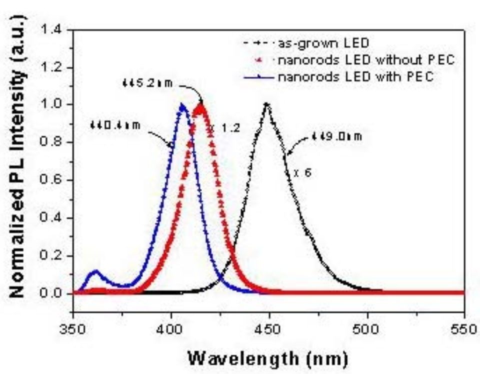
Fig. 8(c) shows the normalized PL intensity spectrum of the as-grown LED and nanorods LED with/without PEC. An enhancement by a factor of 6/5 times in photoluminescence intensities of nanorods with/without PEC process compared to that of as-grown structure. The peak wavelength observed from PL measurement shows a blue shift of 3.8 nm of the nanorods without PEC oxidation process and 8.6 nm of the nanorods with PEC oxidation process from that of the as-grown LED sample. The blue shift maybe is attributed to strain relaxation in the well for nanorods LED and intensity enhanced by scattering effect. The Fig. 8(d) shows the normalized EL spectrum of the as-grown LED and nanorods LED samples with PEC process at an injection current of 1mA. The EL spectrum shows 10.5 nm blue-shift of the nanorods with PEC from that of the as-grown LED sample.



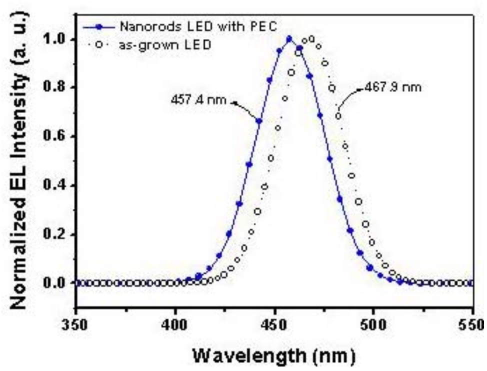
(a)



(b)



(c)



(d)

Figure 8 The SEM images of (a) InGaN/GaN MQW nanorods LED after ICP-RIE etching. (b) InGaN/ GaN MQW nanorods LED after deposited contact metal. (c) Normalized PL intensity spectra for as-grown LED and nanorods LED with/without PEC at room temperature. (d) Normalized EL intensity spectra for as-grown LED and nanorods LED with PEC at room temperature.

10-9. Study of high Q micro-cavity light emitting diode (MCLED)

In this part, we mainly develop the micro-cavity light emitting devices with high quality factor. The fabricated structre of the high Q GaN-based micro-cavity light emitter is shown in figure 9(a). It also has a similar structure with the GaN VCSEL which is consist of a 25-pairs high-reflectivity AlN/GaN DBR (R = 98%), a 3λ InGaN/GaN active pn-junction region and an 8-pairs SiO2/Ta2O5 DBR (R = 99%). The MCLED shows that the emission intensity superlinearly increased with a very narrow linewidth of 0.52 nm equivalents to cavity Q value of 895 at driving current of 10 mA and a dominant emission peak wavelength at 465.3 nm (Figure 9(c). The quality factor is the best value compared to those previously published value. Moreover, the MCLED also shows an invariant emission peak wavelength with the varying current (Figure 9(d)). It means the photon emission could be highly control using this structure. The results should be promising for developing a number of high performance light emitters, including GaN-based VCSELs.

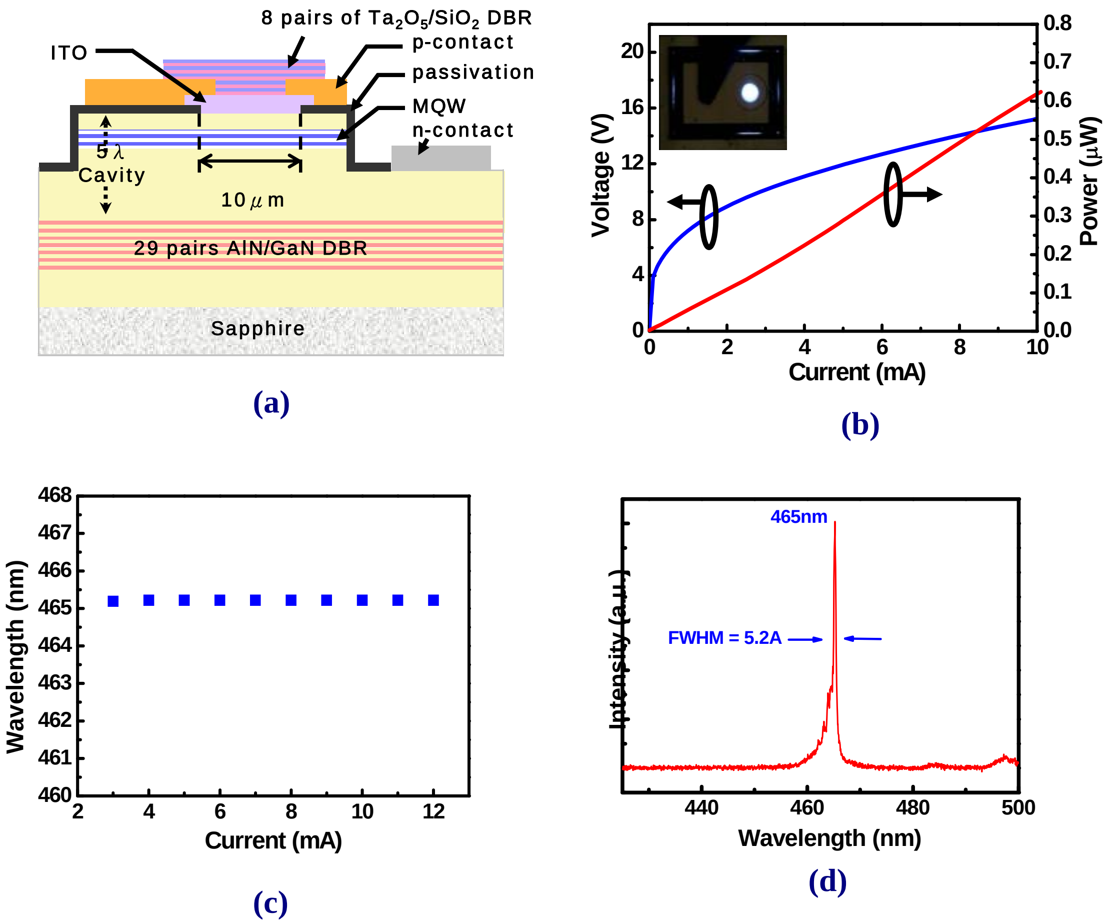


Figure 9 (a) The schematic diagram, (b) L-I-V curves, (c) The emission spectra, and (d) The variation of wavelength of GaN MCLED.

10-10. High-Performance GaN-based vertical-injection light-emitting diodes with TiO_2–SiO_2 Omnidirectional reflector and n-GaN roughness

We have designed and fabricated a new type of GaN-based thin-film vertical-injection light-emitting diode (LED) with TiO_2–SiO_2 omnidirectional reflector (ODR) and n-GaN roughness. The associated ODR designed for LED operation wavelength at 455 nm was integrated with patterned conducting channels for the purpose of vertical current spreading. With the help of laser lift-off and photo-electrochemical etching technologies, at a driving current of 350 mA and with chip size of 1 mm × 1 mm, the light–output power and the external quantum efficiency of our thin-film LED with TiO_2–SiO_2 ODR reached 330 mW and 26.7%. The result demonstrated 18% power enhancement when compared with the results from the thin-film LED with Al reflector replace.

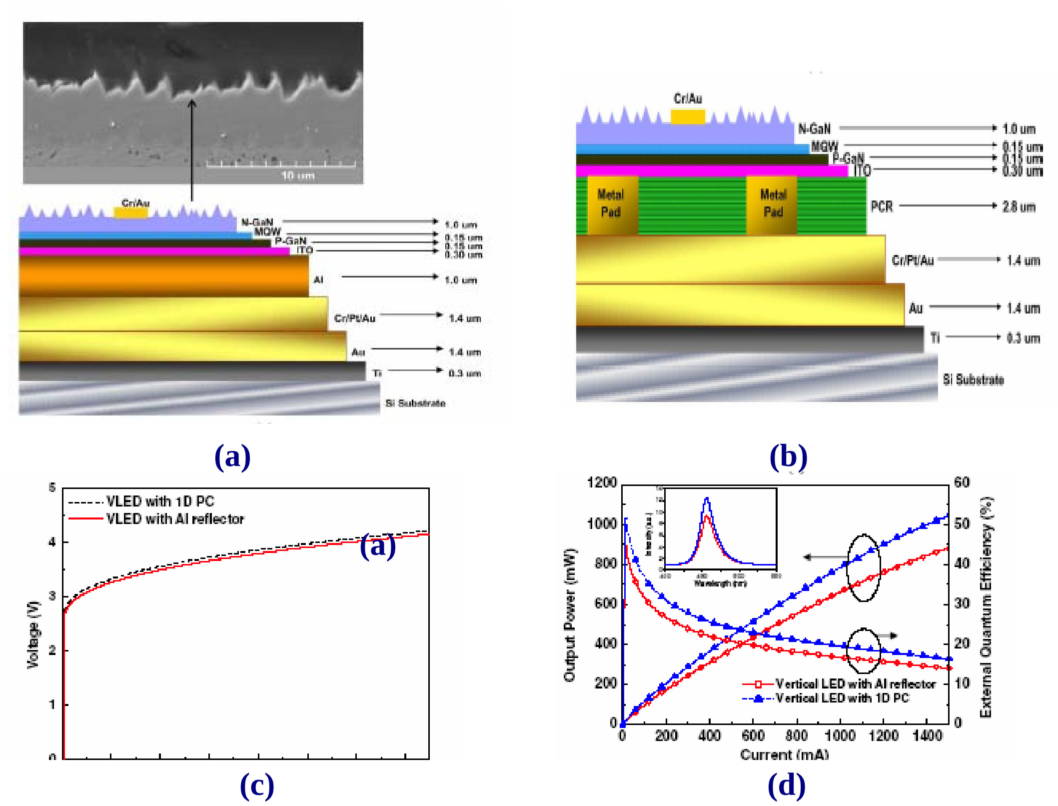
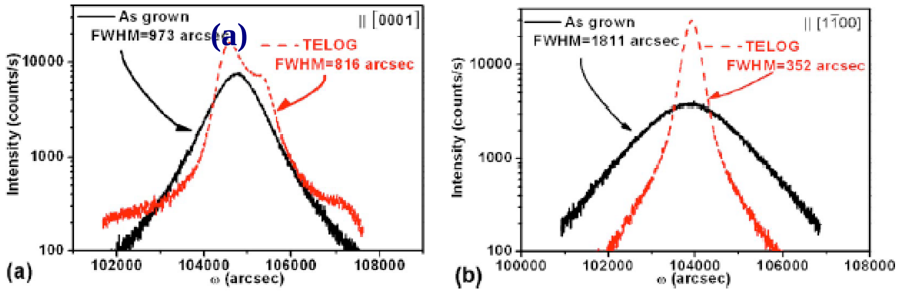


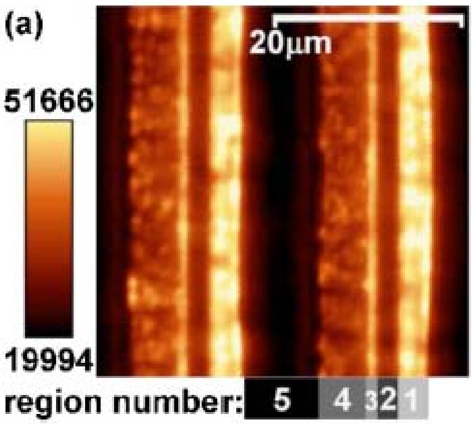
Figure 10 Schematic diagram of a VLED structure (a) with Al mirror and roughness (b) TiO2–SiO_2 ODR and roughness. Inset in (a) shows the SEM image of surface roughness with PEC process. (c) I–V and (d) intensity–current (L–I) and EQE versus forward dc current for the LED with TiO2–SiO2 ODR and roughness, and for the LED with Al reflector and roughness fabricated in this letter. The inset shows the room-temperature EL spectrums at a driving current of 350 mA.

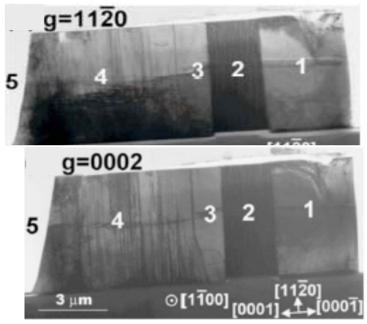
10-11. Trenched epitaxial lateral overgrowth of fast coalesced a-plane GaN with low dislocation density

We have grown high quality and fully coalesced a-plane GaN films at the thickness of 10 μm by using trenched epitaxial lateral overgrowth (TELOG) with a 2 μm seed/18 μm trench stripe pattern. Fig.1 shows the results of x-ray measurement. The FWHMs of x-ray rocking curves along (0001) c and (1-100) m directions were reduced from 973 to 385 arc sec and from 1811 to 260 arc sec, respectively, demonstrating the improvement of the crystal quality and the mitigation of the anisotropic in-plane strains between different crystal axes by TELOG. According to the results of μ-PL and TEM, the TDD can be reduced largely from 1×1010 to 3×107 cm−2 for the N-face GaN wing, which was shown in Fig.2. The Ga-face GaN could be much easily influenced by the thin GaN layer grown on the bottom of trench, indicating that a narrower stripped GaN seeds and deeper trench etched into the surface of sapphire can derive a better quality a-plane TELOG GaN film for the most of the area.



(b)





(d)

(c)

Figure 11 X-ray rocking curves of as-grown and TELOG a-plane GaN films (a) along (0001) direction (b) along (1-100) direction.(c) Top view μ-PL image of TELOG a-plane GaN film. (d) and (e) Cross-sectional TEM g=(0002) and g=(11-20) two beam bright field images.

10-12. InGaN/GaN nanostripe grown on pattern sapphire by metal organic chemical vapor deposition

We have used MOCVD to fabricate InGaN/GaN MQWs nano-stripes on trapezoidally patterned sapphire substrates. A series of special relations and planes of crystallization were defined by diffraction pattern analysis and TEM observations, which was shown as Fig. 12. The nano-stripe structures existed on top of the trapezoid pattern of the sapphire substrate in zone I. In the TEM images, the MQW structures appeared only in zones I and III. No MQW structures were detected from TEM observation of zone II, indicating that the growth direction might occur only toward the top and lateral facets of the trapezoidally patterned sapphire. Fig. 12(f) shows the results of μ-PL experiments which indicate that the intensity of the luminescence from the MQWs embedded in the nano-stripe structure was enhanced up to fivefold relative to those of regular thin film MQWs, probably as a result of much-improved internal and external quantum efficiency. Meanwhile, dislocations that stretched from the interfaces between the GaN and the substrates did not pass through the MQWs in the TEM observation (Fig. 12(g)). Therefore, these MQW nano-stripe arrays are capable of enhancing luminescence and appear to be suitable for application to the fabrication of high-efficiency light-emitting devices.

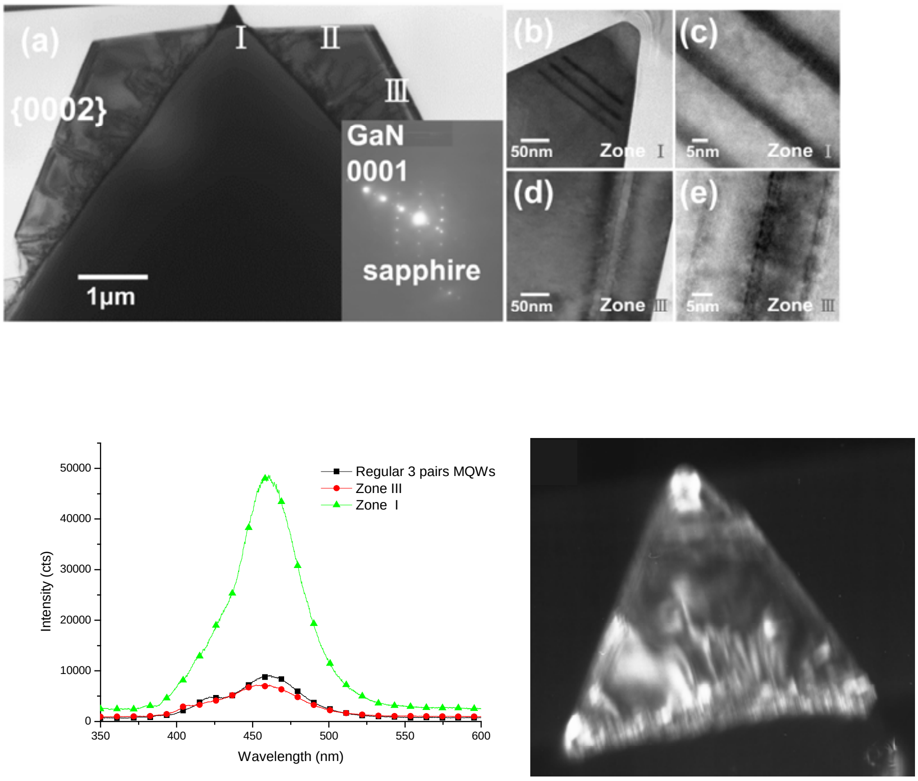
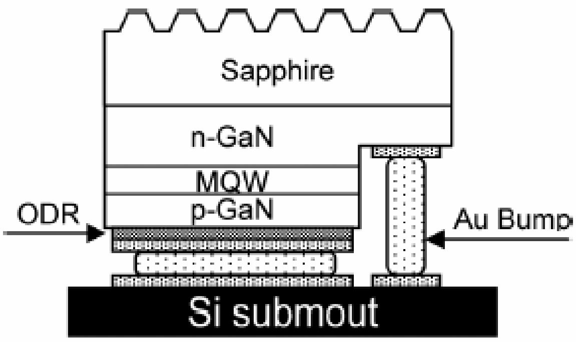
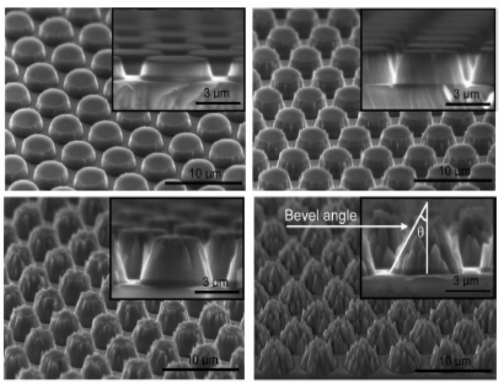


Figure 12 (a) Cross-sectional TEM image of the trapezoid structure. The crystalline orientation between GaN and sapphire in zone Ⅲ was defined by diffraction pattern as shown in the inset. (b)(c) High resolution TEM images with different magnifications of the MQWs in zone Ⅰ. (d)(e) High resolution TEM images with different magnifications of the MQWs in zone Ⅲ. (f) PL spectra of zone Ⅰ, zone Ⅲ and a conventional thin film 3 pairs MQWs. (g) The cross-section dark-field TEM images of the nano-stripe.

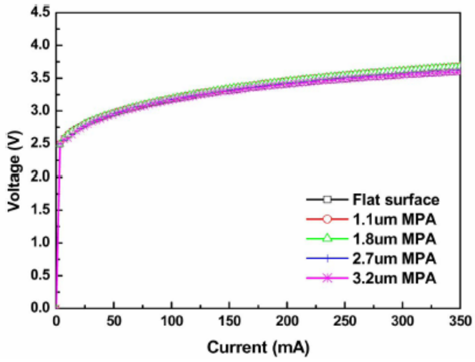
10-13. Enhancement of flip-chip light-emitting diodes with Omnidirectional reflector and textured micropillar arrays

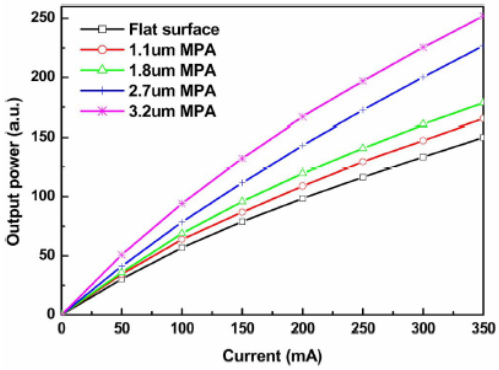


(a)



(b)



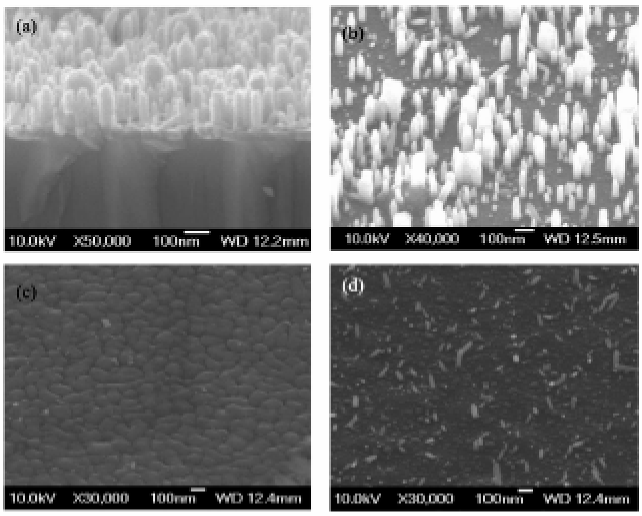


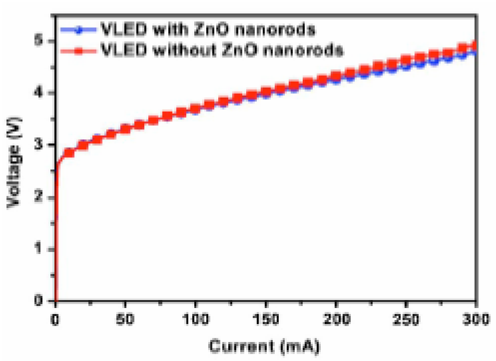
(c) (d)

The flip-chip light-emitting diodes (FC-LEDs) with a conductive omni-directional reflector and textured micropillar arrays were investigated. The micropillar arrays structure was formed on the bottom side of sapphire substrate by dry etching process to increase the light-extraction efficiency. Fig. 12(a) shows the schematic diagram of FC-LEDs structure with micropillar arrays surface. The surface morphology of the FC-LED with different etching condition sapphire surface was examined by scanning electron microscope as shown in Fig. 12(b). The corresponding current–voltage (*I–V*) characteristics of flat surface FC-LEDs were also measured, respectively, as shown in Fig.12(c). The light output power of the FC-LED was increased by 65% for a 3.2-µm textured micropillar on the bottom side of the sapphire substrate as shown in Fig. 12(d). Our work offers promising potential for enhancing output powers of commercial light-emitting devices.

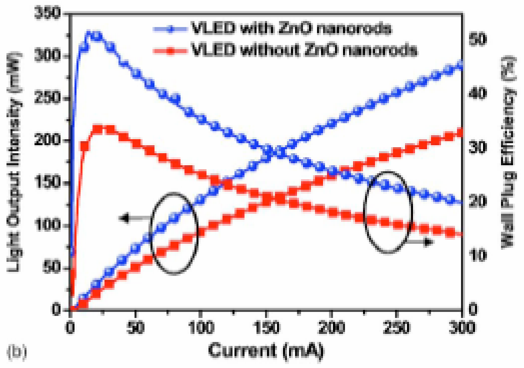
10-14 Enhancement of light output intensity by integrating ZnO nanorod arrays on GaN-based LLO vertical LEDs

Enhancement of light output intensity for GaN-based vertical light-emitting diodes, combining wafer bonding and the laser lift-off (LLO) process, employing an omnidirectional extraction surface with synthesized single-crystal ZnO nanorod arrays in aqueous solution at room temperature is presented. Figure 13(a) to 13(d) shows the FESEM images of the synthesized ZnO nanorods on different surfaces. Figure 13(e) shows the current to voltage (I-V) curve of the VLED with and without ZnO nanorods. The light output intensity and wall-plug efficiency of the GaN-based LLO vertical LED with the omnidirectional extraction surface by ZnO nanorod arrays shows 38.9 and 41.2% increases, respectively, at 200 mA current injections compared to that of a vertical LED without ZnO nanorod arrays as shown in figure 13(f). The ZnO nanorod arrays not only support a current spreading layer but enhance the probability of photon escape through the omnidirectional extraction surface.





(e)



(f)

Figure 13. FESEM images of the GaN-based LEDs with ZnO nanorod arrays: (a) cross-sectional image of the synthesized ZnO nanorod arrays, (b) images of the n-GaN surface, (c) images of the bonding pad metal surface, and (d) images of the passivation SiO2 surface. (e) *I-V* and (f) *L-I* and WPE vs forward dc current for the GaN-based LLO LED with ZnO nanorod arrays and that without ZnO nanorod arrays fabricated in this letter.

11. ctagonal Quasi-Photonic Crystal Nanocavity Lasers with Side-Mode Reduction and Condensed Device Size :（Po-Tsung Lee）

- We first propose a brand new single-defect nanocavity by using octagonal (8-fold) quasi-periodic photonic crystal (QPC) lattice. Both in finite-difference time-domain (FDTD) simulations and experimental measurements, we successfully confirm the resonance and lasing of WG mode with azimuthal number four in this nanocavity.
- In numerical simulations, we also identify all resonance modes in the nanocavity. We find that resonance modes are far away from each other in frequency. This is an advantageous property for reducing the influence of side modes in the nanocavity, which is better than other reported photonic crystal single-defect nanocavities.
- Due to the central zero-field distribution of WG mode profile, we successfully reduce the side mode by inserting a central air hole in the nanocavity without affecting the WG mode resonance. The side-mode suppression-ratio (SMSR) is increased up to larger than 30dB. We also investigate and discuss the possibility of electrical-driven structure based on this WG mode.
- Due to the isotropic photonic bandgap (PBG) effect of octagonal QPC lattice, we successfully obtain the WG mode lasing actions with very condensed device size of 3.5 μm × 3.5 μm and low effective threshold power of 0.2 mW. This indicates that this device can be easily integrated into PICs without affecting other integrated devices, which is a very important property.

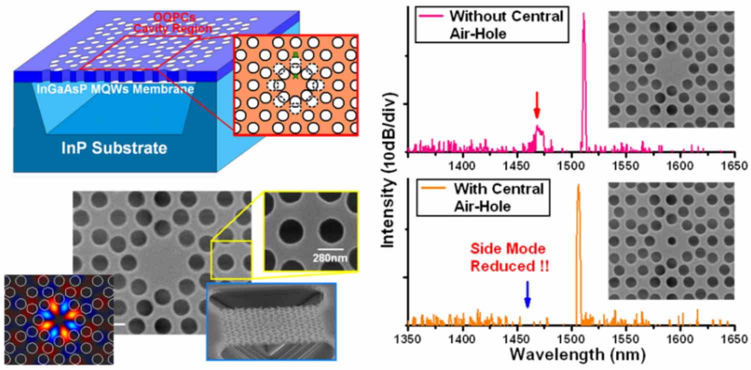


Fig. 1: (Left) The scheme of single-defect nanocavity design and the scanning-electron microscope (SEM) pictures of fabricated devices. (Right) The WG mode lasing actions and its side mode reduction after inserting perturbation in the central of the nanocavity.

12. High Quality Factor Dodecagonal QPC Microcavity Laser and Its Strong Mode Dependence :（Po-Tsung Lee）

- We propose and design a microcavity based on 12-fold QPC lattice with well-sustained WG mode and without any cavity modification, which is very different from octagonal QPC single-defect nanocavity.
- In numerical simulations, we successfully obtain the well-sustained WG mode with azimuthal number six and identify all resonance modes in the microcavity.
- We obtain a very high measured quality (*Q*) factor of 10,000 from well-fabricated devices.
- By randomly varying the outer and inner-most lattice positions of the microcavity, we propose and confirm a strong WG mode dependence on nearest air holes in theory and experiments. This is a very important conclusion and provides us the concept for our following researches to enhance WG mode in ordinary photonic crystal microcavities.

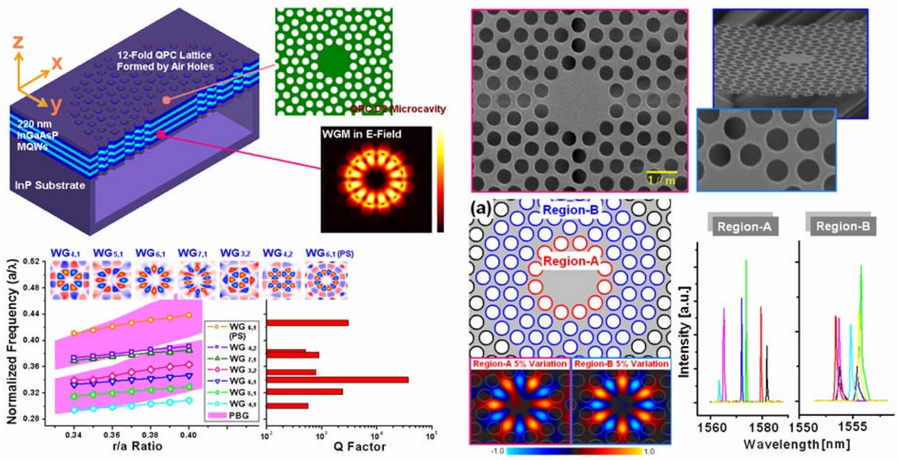


Fig. 2: (Left) The scheme of 12-fold QPC microcavity with WG mode and the simulated resonance modes properties. (Right) The SEM pictures of fabricated devices and its strong mode dependence under different cavity boundary conditions.

13. Circular Photonic Crystal with Isotropic PBG Effect and Its High *Q* Microcavity Laser :（Po-Tsung Lee）

- We also investigate a novel QPC lattice structure named circular photonic crystal (CPC). By using FDTD simulations, we successfully confirm the better PBG isotropy compared with that of ordinary photonic crystals, including the variations of PBG width and boundary in different lattice directions.
- Using this isotropic PBG effect, we design a CPC microcavity with WG mode and high *Q* factor. In experiments, we successfully obtain measured *Q* factor as high as 11,000 and ultra-low effective threshold power smaller than 20 μW. It is worth to note that this is the highest *Q* factor ever reported in photonic-crystal-based microcavity by using multiple quantum wells (MQWs). Thus, the published results have been selected for Virtual Journal of Nanoscale Science & Technology in the issue of Apr. 30, 2007.

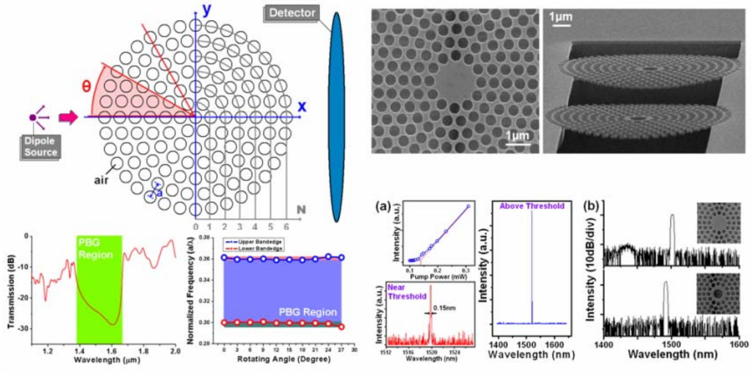


Fig. 3: (Left) The scheme of circular photonic crystal and its isotropic photonic bandgap effect. (Right) The SEM pictures of fabricated devices and its lasing action with high *Q* factor of 11,000.

14. Enhanced WG Mode in Photonic Crystal Circular-Shaped Microcavity and Its Uniform Coupling Properties in Cavity-Waveguide System : （Po-Tsung Lee）

- We first propose the concept of combining topology and micro-gear lasers to enhance the WG mode in a photonic crystal microcavity by modifying the cavity boundary by repositioning the 12 nearest air-holes around the cavity.
- In numerical simulations, we successfully confirm and obtain the existence of enhanced WG mode. We also obtain a high measured *Q* factor of 7700 from well-fabricated devices.
- Both in simulations and experiments, we first investigate the uniform photonic crystal cavity-waveguide coupling property due to the presence of WG mode. This provides a promising solution for serious non-uniform cavity-waveguide coupling problems in most photonic crystal nano- and micro-cavities.

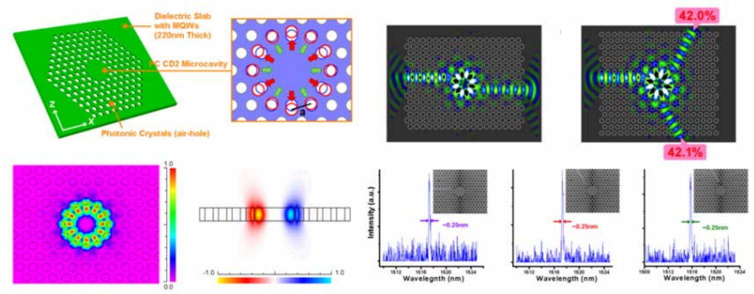


Fig. 4: (Left) The scheme of photonic crystal circular-shaped microcavity and its enhanced WG mode. (Right) The uniform coupling properties both in simulations and experiments are obtained when combining the cavity with external waveguides.

15. Volume Holographic Data Storage（Profs. Ken Yuh Hsu and Shiuan Huei Lin）

The main target of this project is to explore novel materials for volume and/or dynamic holographic recording and its applications on ultrahigh density storage (~Tbits/in^2). During the forth year of project, we have investigated on the optimization of our doped PMMA photopolymers. In the holographic data storage experiments, we have fabricated a 5-inch diameter photopolymer disk with 2-mm thickness. It was put into a shift-multiplexed holographic data storage

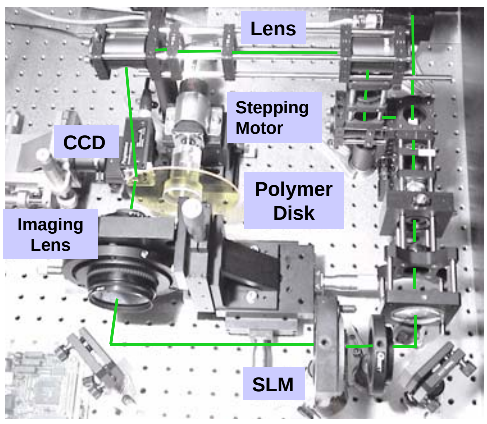


Fig. 1 The picture of holographic data storage system

system (shown in Fig. 1.) and used to stored binary data as a computer data bank. We have written ~57 holograms, at a storage density of ~ 175 bits/μm^2, corresponding to ~ 150GB of the storage capacity in this 5-inch disk. Raw bit error rate has been estimated to be ~0.0015. This result demonstrates that our material can support for the high-quality volume holographic storage applications. This system is suited for fundamental investigations of the material aspects of PQ:PMMA; however, as typical experimental setups with numerous facilities for mechanical and optical adjustments, they are not optimized in terms of system complexity. In order to improve the commercial prospect of a holographic mass storage based on doped photopolymers, read/write setups with reduced system complexity and with the potential to be fabricated at low cost are necessary. In forth year, we start to design a particularly promising system architecture that is based on the concept of planar-integrated free-space optics (PIFSO).

The idea of PIFSO is to miniaturize and "fold" a free-space optical system with a certain desired functionality into a transparent substrate of a few millimeters thickness in such a way that all optical components fall onto the plane-parallel surfaces. Passive components such as lenses or beam deflectors can then be integrated into the surfaces, for example, through surface relief structuring, and the implementation as diffractive optical components offers an almost unlimited design freedom. Active components such as optoelectronic I/O devices can be bonded on top of the plane-parallel substrates. Reflective coatings ensure that optical signals propagate along zigzag paths inside the substrate. Since all passive components are arranged in a planar geometry, the optical system can be fabricated as a whole using mask-based techniques. Lithographic precision for the lateral positioning of components is thereby ensured.

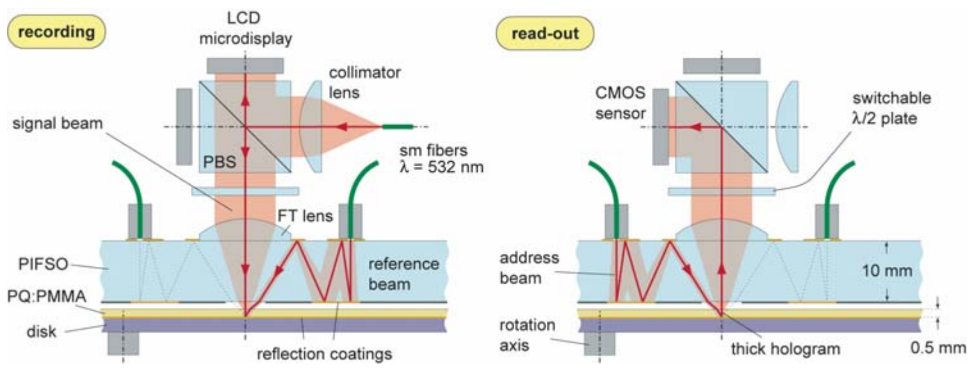


Figure 2 Schematic setup of the PIFSO-type reflection holographic read/write system depicting it in the recording and in the read-out mode. Reference and address beams are exactly counterpropagating along zigzag paths inside the PIFSO substrate. The FT lens performs an optical Fourier transformation from the LCD and the CMOS sensor to the PQ:PMMA layer on the storage disk.

We apply the PIFSO principle for the construction of a read/write head for holographic storage disks. Figure 2 shows the proposed bidirectional Fourier optical system architecture in the recording and the readout mode. One can recognize an orthogonal signal beam, skew reference, and address beam paths that intersect at a target position on the reflective lower side of the photosensitive layer of the storage disk on which the hologram is recorded. All beams originate from the same laser source from which they are coupled into the PIFSO system by single-mode optical fibers. The relay of the signal beam from the fiber end to the disk is carried out by a 4-f system; in its Fourier plane, the expanded beam is 2D spatially modulated by a LCD microdisplay. To be able to record a complete signal page without loss, the diameter of the reference beams has to be matched to the width of the signal spectrum at the disk. Reference and address beams are furthermore perfectly collimated and counterpropagating so that they can be considered as mutually phase conjugate. Hence, if the reference beam is used for the recording of a hologram, then a readout with the address beam will generate the phase-conjugate version of the original signal beam; this reconstructed beam propagates through the 4-f system in the opposite direction and is projected onto a CMOS sensor.

In summary, during this year a strategy using doped photopolymers to fulfill most of the material requirements has been proposed and demonstrated. The concept of using planar-integrated free-space optics to realize microintegration of the optical read/write head has been explored. With these two innovations, we anticipate further accelerated advances in page-oriented holographic data storage techniques in the near future that may eventually lead to a scientific breakthrough.

4.A Summary of the Post-Project Plan (If there are any plan or budget adjustment for FY 2009, please provide detailed description and association with the project in Appendix I)

THz communication is one of the holy grails for researchers in THz science and technology. While tremendous progress has been made in THz sensing and imaging, novel concepts and devices are needed for making such services commercially viable. Recently we have made significant advances in both areas, e.g., the demonstration of directly modulated THz audio and burst communication link and integrated THz biosensing chip. At the same time, we note that commercialization of 60 GHz Radio-over-fiber technology has caught the attention of global leaders in high-tech industries. In this project, we propose to leverage expertise of leading Taiwanese groups in THz science and technology, optoelectronics and optical fiber communication to demonstrate certain milestones of multi-service THz Radio-over-fiber communication and sensing network for future ultra-broadband media, data and biomedical applications. These include:

1. Demonstration of efficient sub-THz (100- to 500 GHz) photonic THz transmitter and receiver.
2. Demonstration of data encoding on THz signals in the 10s of Mb/s range
3. Design and development of GaN-based room-temperature GaN-based Quantum Cascade Lasers for THz communication and sensing.
4. Conception demonstration of low-cost 60GHz radio-over-fiber communication system.
5. Development of fiber-compatible integrated THz biosensing biochips.

Realizing these tasks should catch eyes and ears of the world and help the local electronic, optoelectronic and wireless communication industries leapfrog over international competitors. This holds the future of a new multi-billion vertically integrated high-tech industry. The proposal submitted to Foresight Taiwan was unfortunately not approved. Nonetheless, we will push ahead with the idea. The first phase of this work will be supported by the Academic Top University Program of NCTU. It involves key PIs of SP-I and SP-II of the current PPAEU-II project, e.g., Profs. Ci-Ling Pan, Yin-Chieh Lai and Hao-Chung Kuo. Prof. Pan has also submitted a personal proposal, entitled "towards THz communication technologies (I)," to the NSC.

In collaboration with Prof. C. T. Lee (NCKU), several of us (Profs. Jung Y. Huang, Ci-Ling Pan, Hao-Chung Kuo, and Dr. Jia-Min Shieh) have submitted a proposal to the National Nanoscience Program, entitled, "Photovoltaic technology with self-assembled nanostructures of silicon quantum-dots in mesoporous silica". As outlined above, enhanced UV-to-NIR photoresponse has been reported for a photodiode with dense silicon quantum-dots embedded in MS. Phototransistor-like operation due to enhanced exciton resonant tunneling and injection was observed. We thus propose a related solar cell structure made of a superlattice of silicon quantum dots with gradually varying sizes inserted between p- and n-type tailored mesoporous materials. To enhance the PV efficiency, various approaches involving cost-effective methods for transmission enhancement of solar energy will be investigated. For example, a double-layer anti-reflective structure consisting of a dielectric film and a mesoporous layer of low refractive index will render the front surface of the device more effective in capturing photons. Preliminary results confirm the validity of this approach. Further, Indium-Tin Oxide (ITO) nanostructures not only offer broad *angular* and *spectral* anti-reflective characteristics, but also improve the electric properties of the cell, reducing the screen ratio of metal contacts. Works are ongoing at NCTU and laboratories of our collaborator, Prof. Shawn Y. Lin of RPI. Moreover, surface plasmonic effects using periodic and random metal nano-particles can be designed to enhance the transmission in the vicinity of bandgap energy. A recent report in Science magazine suggests that silicon nano-pillar structures can significantly alter the thermoelectric properties of bulk material. Hence, we will explore nanostructures with a high thermoelectric coefficient in order to harvest the waste heat from p-n junctions. In addition, a surface plasmonic coupling layer or even an optical antenna structure can be employed to offer free-space-to-device photon-capturing functionality without coupling loss. Finally, a wavelength up-conversion layer can be realized with appropriate nanocrystals embedded in MS to convert solar radiation from near IR to the visible region, promising efficient use of photons over the entire range of AM1 solar spectrum.

5. International Cooperation Activities (optional)

Coherent and THz Photonics Group

5-1. Industrial Research Limted (IRL), Auckland, New Zealand

IRL is an independent research organization sponsored mainly by the government of New Zealand. Its mission is similar to that of ITRI. The topic is THz acouostic spectroscopy. The objective of this program is to conduct research on a novel THz-acoustic spectroscopy technique that extends conventional 2D THz spectroscopy beyond the surface boundary. The ultimate goal is to create a 3D material composition image by capturing the spectroscopic information of objects embedded inside a complex medium. Dr. K. L. Chan of IRL visited NCTU for 10 days in December 2006 and conduct preliminary experiments in our laboratories. Inititial results are promising.

5-2. Chinese University Hong Kong.

Mr. K. C. Chen, a Ph.D. student of CUHK, visited the lab of Prof. Ci-Ling Pan for about a month and conducted joint experiment. The first topic is CW THz generation using oxygen-implanted GaAs.

5-3. Institute of Radio Engineering an Electronics, Russian Academy of Science

The groups of Profs. Ru-Pin Chan Pan and Ci-Ling Pan are collaborating with the group of Prof. Dr. V. Meriakri and his collaborators. The general aim of this project is to pursue the dielectric properties of a homologous serious of nematic liquid crystals in the millimeter and sub-millimeter (THz) wavelength range. NCTU is responsible for studies in the sub-millimeter wavelength range, while the Russian team is responsible for similar studies in the longer wavelengths (microwave and millimeter wave).

5-4. IFIPS Optronique, Université Paris XI

Prof. Ci-Ling Pan hosted three French intern students, Sébastien Avila, Génel Farcy, and Arnaud Lacronix, from the Institut de Formation d/Ingenierus, Universite Paris-Sud XI. They stayed for five months and each finished a term project.

Many international scholars visit our team and the scholar exchange have been very useful. These include Profs. K. T. Chan (CUHK), Tsing Hua Her (UNC), Chi H. Lee (Maryland), and Hideo Takezoe (Tokyo Inst. Of Technol.).

VI. Appendix I: Minutes from Program Discussion Meetings

Description of Budget and Project Adjustments for FY 2008

None.

VII. APPENDIX II:

1. PUBLICATION LIST (CONFERENCES, JOURNALS, BOOKS, BOOK CHAPTERS, etc.)

[International Journals]

A. Coherent and THz Photonics

1. Ru-Pin Pan, Chao-Yuan Chen, Tsong-Ru Tsai, and Ci-Ling Pan, “Terahertz Phase Shifter With Nematic Liquid Crystal In A Magnetic Field,” Mol. Cryst. Liq. Cryst., Vol. 421, pp. 157–164, 2004.
2. Ci-Ling Pan, Minjay Huang And Ru-Pin Pan, “Liquid-Crystal-Based Tunable Filter For WDM (λ = 1550 nm),” Mol. Cryst. Liq. Crystl., Vol. 413, pp. 561-568, 2004.
3. Ru-Pin Pan, Yu-Pin Lan, Chao-Yuan Chen, and Ci-Ling Pan, “A Novel Tunable Diode Laser with Liquid Crystal Intracavity Tuning Element,” Mol. Cryst. Liq. Cryst., Vol. 413, pp. 499-506, 2004.
4. Ru-Pin Pan, Tsong-Ru Tsai, Chiunghan Wang, Chao-Yuan Chen, And Ci-Ling Pan, “The Refractive Indices of Nematic Liquid Crystal 4, 4’-n-pentylcyanobiphenyl in the THz Frequency Range,” Mol. Cryst. Liq. Crystl., Vol. 409, pp. 137-144, 2004.
5. Wen-Tse Shih, Jung Y. Huang, and Jing Y. Zhang, Field-induced re-orientation dynamics of surface stabilized ferroelectric liquid crystal mixture, Liquid Crystals 31, 1-9, 2004.
6. Gong-Ru Lin, Yu-Sheng Liao, and Guang-Qun Xia, “Dynamics of optical backward injection induced gain-depletion modulation and mode-locking in semiconductor optical amplifier fiber laser,” Optics Express, Vol. 12, No. 10, pp. 2018-2026, May 2004.
7. Hsiao-Hua Wu, Tzer-Liang Liu, and Yi-Chyun Chen, Ci-Ling Pan “Photoconductive generation of duration-variable short electrical pulses on coplanar waveguides with long carrier life time substrate,” Rev. Sci. Instrum., Volume 75, Issue 5, pp. 1369-1371, May 2004.
8. L.-H. Laih, H.-C. Kuo, Gong-Ru Lin, L.-W. Laih, and S. C. Wang, “As+-implanted AlGaAs oxide-confined VCSEL with enhanced oxidation rate and high performance uniformity”, IEEE Photonics Technology Letters, Vol. 16, No. 6, pp. 1423-1425, June 2004.
9. Gong-Ru Lin and Chun-Jung Lin, “Improving the Blue-Green Electroluminescence of a Metal-Oxide-Semiconductor Diode on SiO2/Si by Multi-Recipe Si-Ion-Implantation and Long-Term Annealing”, Journal of Applied Physics, Vol. 95, No. 12, pp. 8482-8486, June 2004
10. Chao-Yuan Chen, Cho-Fan Hsieh, Yea-Feng Lin, Ru-Pin Pan, and Ci-Ling Pan, “Magnetically Tunable Room-Temperature 2π Liquid Crystal Terahertz Phase Shifter,” Opt. Express, Vol. 12, No. 12, pp. 2625-2630 June 14, 2004, selected by the Virtual Journal of Ultrafast Science, Vol. 3, No. 9, September 2004.
11. Tze-An Liu, Masahiko Tani, Makoto Nakajima, Masanori Hangyo, Kiyomi Sakai, Shin-ichi Nakashima, and Ci-Ling Pan, “Ultrabroadband terahertz field detection by photoconductive antennas based on proton-bombarded InP,” Opt. Express, Vol. 12, No.13, pp. 2954-2959, June 28, 2004, selected by the Virtual Journal of Ultrafast Science, Vol. 3, No. 8, August 2004.
12. Gong-Ru Lin, Yu-Huang Lin, and Yung-Cheng Chang, “Theory and Experiments of a Mode Beating Noise Suppressed and Mutually Injection-Locked Fabry-Perot Laser Diode and Erbium-Doped Fiber Amplifier Link”, IEEE Journal of Quantum Electronics, Vol. 40, No. 8, pp. 1014-1022, August 2004..
13. Yu-Huang Lin and Gong-Ru Lin, “Reduction of Mode Beating Noise in Erbium-Doped Fiber Laser by Mutual Injection-Locking with a Laser Diode at below Threshold Condition”, IEEE Photonics Technology Letters, Vol. 16, No. 8, pp. 1819-1821, August 2004.
14. Gong-Ru Lin, Chun-Jung Lin, and Chi-Kuan Lin, “The Defect Enhanced Photoconductive Response of Silicon-Implanted Borosilicate Glass”, Applied Physics Letters, Vol. 85, No. 6, pp. 935-937, August 2004.
15. Gong-Ru Lin, Kuo-Cheng Yu, Chun-Jung Lin, Hao-Chung Kuo, and M.-J. Ou-yang, “Pumping Intensity Dependent Surface Charge Accumulation and Red-Shifted Micro-Photoluminescence of Si-Implanted Quartz,” Applied Physics Letters, Vol. 85, No. 6, pp. 1000-1002, August 2004.

16. Gong-Ru Lin, Yu-Sheng Liao, and Jung-Rung Wu, "Harmonic Injection-Locking Behavior of Frequency-Detuned Optical Pulse in Erbium-Doped Fiber Laser," Japanese Journal of Applied Physics, Pt. 1, Vol. 43, No. 8A, pp. 5204-5208, August 2004.
17. Gong-Ru Lin, Gong-Cheng Lin, and Jung-Rung Wu, "Optical-Pulse-Injection-Induced 40GHz Photonic Frequency Multiplication in Erbium-Doped Fiber Laser," Japanese Journal of Applied Physics, Pt. 1, Vol. 43, No. 8A, pp. 5285-5288, August 2004.
18. Gong-Ru Lin, Jung-Rung Wu, and Yung-Cheng Chang, "Photonic millimeter-wave generation from frequency-multiplied Erbium-doped fiber laser pulse-train using purely sinusoidal-wave modulated laser diode," Optics Express, Vol. 12, No. 17, pp. 4166-4171, August 2004.
19. Jia-Min Shieh, Zun-Hao Chen, Bau-Tong Dai, Yi-Chao Wang, Alexei Zaitsev, and Ci-Ling Pan, "Near-Infrared Femtosecond Laser-induced Crystallization of Amorphous Silicon," Appl. Phys. Lett., Volume 85, Issue 7, pp. 1232-1234, August 16, 2004, selected by the Virtual Journal of Ultrafast Science, Vol. 3, No. 9, September 2004.
20. Yung-Cheng Chang, Yu-Huang Lin, J. H. Chen, and Gong-Ru Lin, "All-optical NRZ-to-PRZ format transformer with an injection-locked Fabry-Perot laser diode at unlasing condition", Optics Express, Vol. 12, No. 19, pp. 4449-4456, September 2004.
21. Chao-Kuei Lee, Jin-Yuan Zhang, J. Y. Huang and Ci-Ling Pan, "Theoretical and Experimental Studies of tunable UV/Blue Femtosecond Pulses in a 405nm-pumped Type-I β-BBO Non-collinear Optical Parametric Amplifier," J. Opt. Soc. Am. B, Volume 21, Issue 8, pp. 1494-1499, August 2004, selected by the Virtual Journal of Ultrafast Science, Vol. 3, No. 9, September 2004.
22. Gong-Ru Lin, Chun-Jung Lin, and Kuo-Cheng Yu, "Time-Resolved Photoluminescence and Capacitance-Voltage Analysis of the Neutral Vacancy Defect in Silicon Implanted SiO_2 on Silicon Substrate," Journal of Applied Physics, Vol. 96, No. 5, pp. 3025-3027, September 2004, selected by Virtual Journal of Ultrafast Science, Vol. 3, No. 10, October 2004.
23. Ming-Jay Huang, Ru-Pin Pan, Chia-Rong Sheu, Yu-Ping Lan, Yi-Fan Lai and Ci-Ling Pan, "Multimode Optical Demultiplexer for DWDM with Liquid Crystal Enabled Functionalities," IEEE Photon. Technol. Lett., Vol. 40, No. 10, pp. 2254-2256, October 2004, reported by Lightwave Europe, November 2004.
24. Gong-Ru Lin, J.-R. Wu, and Y.-C. Chang, "Rational Harmonic Mode-Locking of Erbium-Doped Fiber Laser at 40 GHz Using a Loss-Modulated Fabry Perot Laser Diode", IEEE Photonics Technology Letters, Vol. 16, No. 8, pp. 1810-1812, August 2004, reported by Jeff Hecht in Laser Focus World, p. 81, December 2004
25. Tsung-Sheng Shih, Yu-Ping Lan, Yea-Feng Lin, Ru-Pin Pan, and Ci-Ling Pan, "A single-longitudinal-mode semiconductor laser with digital and mode-hop-free fine-tuning mechanisms," Optics Express, Vol. 12, No. 26, pp. 6434-6439, December 27, 2004.
26. Ming C. Chen, Jung Y. Huang, Qiantso Yang, C. L. Pan, and Jen-Inn Chyi: "Freezing phase scheme for fast adaptive control and its application to characterization of femtosecond coherent optical pulses reflected from semiconductor saturable absorber mirrors" J. Opt. Soc. Am. B 22, 1134-1142, 2005.
27. Gong-Ru Lin and I-hsiang Chiu, "Femtosecond Compression and Wavelength Tuning of Backward-Optical-Injection Harmonic-Mode-Locked SOA Fiber Laser at 10 GHz," Optics Express, Vol. 13, No. 20, pp. 8772-8780, 3 October 2005, selected by the Virtual Journal of Ultrafast Sciences, Vol. 5, No. 1, January 2005.
28. Gong-Ru Lin, Pai-Shen Hsueh, and Hsiao-Hua Wu, "The detuning characteristics of rational harmonic mode-locked semiconductor optical amplifier fiber-ring laser using backward optical sinusoidal-wave injection modulation", IEEE/OSA Journal of Lightwave Technology, Vol. 23, No. 3, pp. 1325-1333, March 2005.
29. Chun-Jung Lin and Gong-Ru Lin, "White-Light Electro-luminescence of Multi-energy Si-ion-Implanted SiO2 based MOS diode", IEEE Journal of Quantum Electronics, Vol. 41, No. 3, pp. 441-447, March 2005.
30. M. C. Chen, J. Y. Huang, L. J. Chen, "Coherent control multiphoton processes in semiconductor saturable Bragg reflector with freezing phase algorithm," Applied Physics B-Lasers and Optics Vol. 80 No. 3, pp. 333-340, March 2005
31. Gong-Ru Lin, Chun-Jung Lin, Chi-Kuan Lin, Li-Jen Chou and Yu-Lun Chueh, "Oxygen defect and Si

nanocrystal dependent white-light and near-infrared electroluminescence of Si-implanted and plasma-enhanced chemical-vapor deposition-grown Si-rich SiO2." Journal of Applied Physics, Vol. 97, art. 094306, April 2005

32. Gong-Ru Lin and Yu-Sheng Liao, "Sensitivity evaluation of fiber optic OC-48 p-i-n transimpedance amplifier receivers using sweep-frequency modulation and intermixing diagnostics", Optical Engineering, Vol. 44, art. 044002, April 2005.
33. Gong-Ru Lin and J.-R. Wu, "Tenth-Order Rational Harmonic Frequency Multiplication of Optical Pulse-Train in a Regenerative Erbium-Doped Fiber Amplifier", Applied Optics, Vol. 44, No. 12, pp. 2416-2420, April 2005
34. Bor-Yuan Shew, Han-Chieh Li, Ci-Ling Pan and Cheng-Hao Ko, " X-ray micromachining SU-8 resist for a terahertz photonic filter," Journal Of Physics D-Applied Physics Vol. 38, No. 7, pp. 1097-1103, Apr 7 2005
35. Yung-Cheng Chang, Yu-Huang Lin, Yu-Sheng Liao, and Gong-Ru Lin, "Switchable dual-wavelength NRZ-to-RZ data-format transformer using non-DC-biased and synchronously modulated laser diode", IEICE Transactions on Electronics, Vol. E88-C, No. 5, pp. 981-983, May 2005
36. Gong-Ru Lin and Yung-Cheng Chang, "10 Gbit/s tunable dual-wavelength nonreturn-to-zero -to- return-to-zero data-format transformer based on a non-direct-current-biased Fabry-Perot laser diode", Applied Optics, Vol. 44, No. 15, pp. 3058-3062, May 2005.
37. Gong-Ru Lin, Chun-Jung Lin, Chi-Kuan Lin, Li-Jen Chou, and Yu-Lun Chueh, "Oxygen defect and Si nanocrystal dependent white-light and near-infrared electroluminescence of Si-implanted and plasma-enhanced chemical-vapor deposition-grown Si-rich SiO2", Journal of Applied Physics, Vol. 97, No. 9, pp. 094306, May 2005.
38. Ci-Ling Pan, Cho-Fan Hsieh, and Ru-Pin Pan, Masaki Tanaka, Fumiaki Miyamaru, Masahiko Tani, and Masanori Hangyo, "Control of enhanced THz transmission through metallic hole arrays using nematic liquid crystal," Optics Express, Vol. 13, No. 11, pp. 3921 - 3930, May 30, 2005, collected by the Nano-Structured Surfaces Web.
39. Ming C. Chen, Jung Y. Huang, Qiantso Yang, C. L. Pan, and Jen-Inn Chyi, "Freezing phase scheme for fast adaptive control and its application to characterization of femtosecond coherent optical pulses reflected from semiconductor saturable absorber mirrors," Journal of The Optical Society Of America B, Vol. 22, No. 5, pp. 1134-1142, May 2005, selected by the Virtual Journal of Ultrafast Science, Vol. 4, No. 6, June 2005.
40. Gong-Ru Lin, Yung-Cheng Chang, Yu-Huang Lin, and J. H. Chen, "All Optical Data Format Conversion in Synchronously Modulated Single-Mode Fabry-Perot Laser Diode Using External Injection-Locking Induced Nonlinear Threshold Reduction Effect", IEEE Photonics Technology Letters, Vol. 17, No. 6, pp. 1307-1309, June 2005.
41. Gong-Ru Lin, Hao-Chung Kuo, Chi-Kuang Lin, and M. Feng, "Ultralow Leakage In0.53Ga0.47As p-i-n Photodetector Grown on Linearly Graded Metamorphic InxGa1-xP Buffered GaAs Substrate," IEEE Journal of Quantum Electronics, Vol. 41, No. 6, pp. 749-752, June 2005
42. Gong-Ru Lin, Ming-Chung Wu, and Yung-Cheng Chang, "Suppression of Phase and Supermode Noises in a Harmonic Mode-Locked Erbium-Doped Fiber Laser with a Semiconductor Optical Amplifier Based High-Pass Filter," Optics Letters, Vol. 30, No. 14, pp. 1834-1836, July 2005, selected article in Virtual Journal of Ultrafast Science, Vol. 4, No. 7, July 2005.
43. Tze-An Liu, Gong-Ru Lin, Yen-Chi Lee, Shing-Chung Wang, Masahiko Tani, Hsiao-Hua Wu, and Ci-Ling Pan, "Dark Current and Trailing Edge Suppression in Ultrafast Photoconductive Switches and THz Spiral Antennas Fabricated on Multi-Energy Arsenic-Ion-Implanted GaAs," Journal of Applied Physics, Vol. 98, art. 013711, July 2005, selected article in Virtual Journal of Ultrafast Science, Vol. 4, No. 8, August 2005
44. Jin-Wei Shi, H.-C. Hsu, F.-H. Huang, W.-S. Liu, J.-I. Chyi, Ja-Yu Lu, C.-K. Sun, and Ci-Ling Pan, "Separated-Transport-Recombination p-i-n Photodiode for High-Speed and High-Power Performance," IEEE Photon. Technol. Lett., Vol. 17, No. 8, pp. 1722-1724, August 2005.
45. Yung-Cheng Chang and Gong-Ru Lin, "Optically gain-switched laser diode based 10Gbit/s all-optical data format converter", Optics Letters, Vol. 30, No. 16, pp. 2704-2706, 15 August 2005.
46. Jin-Wei Shi, H.-C. Hsu, F.-H. Huang, W.-S. Liu, J.-I. Chyi, Ja-Yu Lu, C.-K. Sun, and Ci-Ling Pan, "Separated-Transport-Recombination p-i-n Photodiode for High-Speed and High-Power Performance," IEEE

Photon. Technol. Lett., Vol. 17, No. 8, pp. 1722-1724, August 2005.

47. Chao-Kuei Lee, Tze-An Liu, Kai-Fung Huang and Ci-Ling Pan, “Frequency Resolved Optical Gating Studies of Strained Saturable Bragg Reflector: Anomalous dispersion near Resonance Absorption of the Exciton Resonance,” Jpn. J. Appl. Phys., Vol. 44, No. 9A, pp. 6553-6557, September 2005
48. Gong-Ru Lin, Ming-Chung Wu, Yung-Cheng Chang, and Ci-Ling Pan, “Ultrahigh supermode noise suppressing ratio of a semiconductor optical amplifier filtered harmonically mode-locked Erbium-doped fiber laser,” Optics Express, Vol. 13, No. 18, pp. 7215–7224, September 5, 2005. 吳銘忠同學獲得 2005 年中國電機工程學會青年論文獎第三名
49. Yu-Ping Lan, Yea-Feng Lin, Yu-Tai Li and Ru-Pin Pan, Chao-Kuei Lee, and Ci-Ling Pan, “Intracavity measurement of liquid crystal layer thickness by wavelength tuning of an external cavity laser diode,” Optics Express, Vol. 13, No. 20, pp. 7905–7912, Oct. 3, 2005.
50. Tang LC, Huang JY, Chang CS, Lee MH, Liu LQ, “New infrared nonlinear optical crystal CsGeBr3: synthesis, structure and powder second-harmonic generation properties,” Journal of Physics-Condensed Matter 17 (46): 7275-7286 Nov 23 2005
51. Tze-An Liu, Gong-Ru Lin, Yung-Cheng Chang, Ci-Ling Pan, “A wireless audio and burst communication link with directly modulated THz photoconductive antenna,” Optics Express, Vol. 13, No. 25, pp. 10416-10423, 12 December, 2005.
52. Chun-Jung Lin, Gong-Ru Lin, Yu-Lun Chueh, and Li-Jen Chou, “Analysis of Silicon Nanocrystals in Silicon-rich SiO2 Synthesized by CO_2 Laser Annealing,” Electrochemical and Solid-State Letters, Vol. 8, No. 12, pp. D43-D45, December 2005.
53. Jung Y. Huang, and Wen T. Shih: “Probing the field-induced submolecular motions in a ferroelectric liquid crystal mixture with time-resolved two-dimensional infrared spectroscopy” J. Phys. C: Condens. Matter 18, 7593–7603, 2006.
54. Chung-Ping Li, Kung-Hwa Wei and Jung Y. Huang: “Enhanced Collective Electron Transport by CdSe Quantum Dots Self-Assembled in the Poly(4-vinylpyridine) Nanodomains of a Poly(styrene-b-4-vinylpyridine) Diblock Copolymer Thin Film” Angewandte Chemie InternationalEdition 45, 1-5, 2006.
55. Chung-Ping Li, Siao-Wei Yeh,Han-Chang Chang, Jung Y. Huang, and Kung-Hwa Wei: “The Orientation of CdSe Nanorods Affects the Electron Mobility of CdSe/P4VP Nanodomains Self-Assembled within a Poly(styrene-b-4-vinylpyridine) Diblock Copolymer Thin Film” Small 2, 359-363, 2006.
56. Chia-Hung Chou, Hsu-Shen Wang, Kung-Hwa Wei and Jung Y. Huang: “Thiophenol-modified CdS nanoparticles enhance the luminescence of benzoxyl dendron-substituted polyfluorene copolymers” Advanced Functional Materials 16, 909, 2006.
57. Chin-Cheng Weng, Chia-Hung Chou, Kung-Hwa Wei, and Jung Y. Huang: “Enhanced Electroluminescence of Poly(2-methoxy-5-(20-ethylhexyloxy)-1,4-phenylene vinylene) Films in the Presence of TiO2 Nanocrystals” Journal of Polymer Research 13, 229, 2006.
58. Chun-Jung Lin, Chao-Kuei Lee, Eric Wei-Guang Diau, and Gong-Ru Lina, “Time-resolved Photoluminescence Analysis of Multidose Si-ion-implanted SiO_2,” Journal of Electrochemistry Society, Vol. 153, pp. E25-E32, January 2006, selected by the Virtual Journal of Ultrafast Sciences, Vol. 5, No. 1, January 2006.
59. Chun-Jung Lin, Y.-L. Chueh, L.-J. Chou, C.-W. Chang, E. W. G. Diau, H.-C. Kuo, and G.-R. Lin, “Countinuous-Wave and Time-Resolved Photoluminescence Analysis of Silicon Nanocrystals Formed by Thermal Annealing of Amorphous Silicon Oxides at Different Times,” Japanese Journal of Applied Physics, Vol. 45, No. 2A, pp. 1040-1043, Feb 2006
60. Chao-Yuan Chen, Cho-Fan Hsieh, Yea-Feng Lin, Ci-Ling Pan and Ru-Pin Pan, “A Liquid-Crystal-Based Terahertz Tunable Lyot Filter,” Appl. Phys. Lett., Vol. 88, 101107, March 6, 2006, selected by Virtual Journal of THz Science and Technology, March 2006.
61. Yi-Chao Wang, Ci-Ling Pan, Jia-Min Shieh and Bau-Tong Dai, “Dopant Profile Engineering by Near-Infrared Femtosecond Laser Activation,” Appl. Phys. Lett., Vol. 88, 1311104, March 27, 2006, selected by Virtual Journal of Nanoscale Science and Technology, Vol. 13, No. 14, April 10, 2006 and Virtual Journal of Ultrafast Science,

Vol. 5, No. 4, April 2006.

62. Cho-Fan Hsieh and Ru-Pin Pan, Tsung-Ta Tang, Hung-Lung Chen, and Ci-Ling Pan, "Voltage-controlled liquid crystal terahertz phase shifter and quarter wave plate," Optics Letters, Vol. 31, No. 8, pp. 1112-1114, April 15, 2006, selected by Virtual Journal of THz Science and Technology, April 2006 and OSA Virtual Journal for Biomedical Optics, Vol. 1, No. 5, May 2006.
63. Gong-Ru Lin, Kun-Chieh Yu, Yung-Cheng Chang, "All-optical pulse data generation in a semiconductor optical amplifier gain-controlled by a reshaped optical clock injection", Applied Physics Letters, Vol. 88, No. 19, 191114, May 2006. Selected by Virtual Journal of Ultrafast Science, Vol. 5, No. 6, June 2006.
64. Gong-Ru Lin, Ci-Ling Pan, and I-Hsiang Chiu, "Supermode-noise-free eighth-order femtosecond soliton from a backward dark-optical-comb-injection mode-locked semiconductor optical amplifier fiber laser," Opt. Lett. Vol. 31, No. 6, pp. 835-837, March 15, 2006, selected by Virtual Journal of Ultrafast Science, Vol. 5, No. 6, June 2006.
65. Gong-Ru Lin and I-hsiang Chiu, "110-pJ and 410-fs Pulse at 10 GHz Generated by Multi-Stage External Fiber Compression of Optically Injection Mode-Locked Semiconductor Optical Amplifier Fiber Laser", IEEE Photonics Technology Letters, Vol. 18, No. 9-12, pp. 1010-1012, May-June 2006.
66. Gong-Ru Lin, Kun-Chieh Yu, and Yung-Cheng Chang, "10 Gbit/s All-Optical NRZ-to-RZ Data Format Conversion Based on a Backward Dark-Optical-Comb Injected Semiconductor Optical Amplifier", Optics Letters, Vol. 31, No. 10, pp. 1376-1378, 15 May 2006. Selected by Virtual Journal of Ultrafast Science, Vol. 5, No. 7, June 2006. (廖育聖與游昆潔先生榮獲九十五年度國教育部通訊競賽研究所組優勝)
67. Ying-Tsung Lin and Gong-Ru Lin, "Dual-Stage Soliton Compression of a Self-Started Additive Pulse Mode-Locked Erbium-Dope Fiber Laser for 48-fs Pulse Generation", Optics Letters, Vol. 31, No. 10, pp. 1382-1384, 15 May 2006. Selected by Virtual Journal of Ultrafast Science, Vol. 5, No. 7, June 2006.
68. Yu-Sheng Liao, Jin-Wei Shi, Y.-S. Wu, Hao-Chung Kuo, M. Feng, and Gong-Ru Lin, "Optically Heterodyne Diagnosis of a High-Saturation-Power Undoped InP Sandwiched InGaAs p-i-n Photodiode Grown on GaAs", Optics Express, Vol. 14, No. 12, pp. 5031-5037, 12 June 2006.
69. Yu-Ting Lin and Chih Chen, Jia-Min Shieh and Yao-Jen Lee, Ci-Ling Pan, Ching-Wei Cheng, Jian-Ten Peng, and Chih-Wei Chao, "Trap-state density in continuous-wave laser-crystallized single-grain-like silicon transistors," Appl. Phys. Lett., 88, 233511 (June 5, 2006), selected by Virtual Journal of Nanoscale Science and Technology, Vol. 13, No. 24, June 19, 2006.
70. Hsin-Ying Wu, Cho-Fan Hsieh, Tsung-Ta Tang, Ru-Pin Pan, and Ci-Ling Pan, "Electrically Tunable Room-Temperature 2π Liquid Crystal Terahertz Phase Shifter," IEEE Photon. Technol. Lett., Vol. 18, No. 14, pp. 1488-1490, July 15, 2006, selected by Virtual Journal of THz Science and Technology, July 2006.
71. Yu-Kuei Hsu, Ching-Wei Chen, Jung Y. Huang, Ci-Ling Pan, Jing-Yuan Zhang, Chen-Shiung Chang, "Erbium doped GaSe crystal for mid-IR applications," Optics Express, Vol. 14, No. 12, pp. 5484-5491, 12 June, 2006, selected by Virtual Journal of Ultrafast Science, Vol. 5, No. 8, August 2006, and OSA Virtual Journal for Biomedical Optics, Vol. 1, No. 7, July 2006.
72. Jin-Wei Shi, Yu-Tai Li and Ci-Ling Pan, M.-L. Lin, Y.-S. Wu, W.-S. Liu and J.-I. Chyi, "Bandwidth Enhancement Phenomenon of a High-Speed GaAs-AlGaAs Based Unitraveling Carrier Photodiode with an Optimally Designed Absorption-Layer at an 830nm Wavelength," Appl. Phys. Lett., Vol. 89, art. 053512, July 31, 2006.
73. Gong-Ru Lin, Hao-Chung Kuo, Huang-Shen Lin, and Chi-Chiang kao, "Rapid Self-Assembly of Ni Nanodots on Si Substrate covered by a Less-Adhesive and Heat-Accumulated SiO_2 Layer", Applied Physics Letters, Vol. 89, No. 7, pp. 073108, August 2006. Selected by Virtual Journal of Nanoscale Science & Technology, Vol. 14, No. 9, August 2006.
74. Yu-Sheng Liao, Gong-Ru Lin, Hao-Chung Kuo, Kai-Ming Feng, and M. Feng, "10Gbit/s Operation of an In0.53Ga0.47As p-i-n Photodiode on Metamorphic InGaP Buffered Semi-Insulating GaAs Substrate", IEEE Photonics Technology Letters, Vol. 18, No. 17, pp. 1822-1824, September 2006.
75. Gong-Ru Lin, C.-J. Lin, L.-J. Chou, and Y.-L. Chueh, "Microphotoluminescence and Microphotoreflectance

Analyses of CO2 Laser Rapid-Thermal-Annealed SiOx Surface With Buried Si Nanocrystals", IEEE Transactions on Nanotechnology, Vol. 5, No. 5, pp. 511-516, September 2006.

76. Gong-Ru Lin, Chi-Kuan Lin, L.-J. Chou, and Y.-L. Chueh, "Synthesis of Si Nano-Pyramids at SiOx/Si Interface for Enhancing Electroluminescence of Si-Rich SiOx Based MOS Diode", Applied Physics Letters, Vol. 89, No. 9, 093126, September 2006. Selected by Virtual Journal of Nanoscale Science & Technology, Vol. 14, No. 12, September 2006.
77. Gong-Ru Lin, Jun-Yuan Chang, Yu-Sheng Liao, and Hai-Han Lu, "L-Band Erbium-Doped Fiber Laser with Coupling-Ratio Controlled Wavelength Tunability", Optics Express, Vol. 14, No. 21, pp. 9473-9479, 16 October 2006.
78. Ching-Wei Chen, Yu-Kuei Hsu, Jung Y. Huang, and Chen-Shiung Chang, Jing-Yuan Zhang, Ci-Ling Pan, "Generation Properties of Coherent Infrared Radiation in the Optical Absorption Region of GaSe," Optics Express, Vol. 14, Issue 22, pp. 10636-10644, Oct. 30, 2006, selected by Virtual Journal of Ultrafast Science, Vol. 6, No. 1, January 2007, listed in Virtual Journal of THz Science and Technology, October 2006.
79. Ching-Wei Chen, Jung Y. Huang and Ci-Ling Pan, "Pulse retrieval from interferometric autocorrelation measurement by use of the population-split genetic algorithm," Optics Express, Vol. 14, No. 22, pp. 10930-10938, Oct. 30, 2006, selected by Virtual Journal of Ultrafast Science, Vol. 6, No. 1, January 2007..
80. Gong-Ru Lin, Hai-Han Lu, and Jun-Yuan Chang, "Wavelength Tunability of a Coupler and Air-Gap Etalon Controlled High-Efficiency L-Band Mode-Locked Erbium-Doped Fiber Laser", IEEE Photonics Technology Letters, Vol. 18, No. 21, pp. 2233-2235, November 2006. (張峻源同學榮獲 2005 年光電科技研討會學生論文獎)
81. Yu-Sheng Liao and Gong-Ru Lin, "Comparison on the Sensitivity of Fiber-optic SONET OC-48 PIN-TIA Receivers Measured by Using Synchronous Modulation Inter-Mixing Technique and Bit-Error-Rate Tester", IEEE Transactions on Intrumentation and Measurements, Vol. 55, No. 6, pp. 2172-2175, December 2006.
82. Gong-Ru Lin, Chun-Jung Lin, Yu-Lun Chueh, and Li-Jen Chou, "Localized CO2 Laser Annealing Induced Dehydrogenation/Ablation and Optical Refinement of Si-Rich SiOx Film with Embedded Si Nanocrystals", Journal of Nanoscience and Nanotechnology, Vol. 6, No. 12, pp. 3710-3717, December 2006.
83. Hsin-Ying Wu, Tsung-Ta Tang, Chih-Chieh Wang, Ru-Pin Pan, Shao-Ju Chang, and Jenn-Chang Hwang, "Controllable Alignment Modes of Nematic Liquid Crystals on Argon Ion Beam Bombarded Polyimide Films", Mol. Cryst. Liq. Cryst. Vol. 475, pp.45-55, 2007.
84. Tsung-Ta Tang , Hsin-Ying Wu, Chia-Jen Lin, and Ru-Pin Pan, "A simple method of determining the pitch of a chiral nematic liquid crystal", Mol. Cryst. Liq. Cryst., Vol. 478, pp. 143-150, 2007.
85. Gong-Ru Lin, Jun-Yuan Chang, " Femtosecond mode-locked Erbium-doped fiber ring laser with intra-cavity loss controlled full L-band wavelength tenability," Optics Express, vol. 15, Issue 1, pp.97-103, 8 January 2007.
86. Jia-Min Shieh, Yi-Fan Lai, and Wei-Xin Ni, Hao-Chung Kuo, Chih-Yao Fang, Jung Y. Huang, and Ci-Ling Pan, "Enhanced photoresponse of a Metal-Oxide-Semiconductor photodetector with Si nanocrystals embedded in the oxide layer," Appl. Phys. Lett., Vol. 90, art. 051105, January 30, 2007, selected by Virtual Journal of Nanoscale Science and Technology, Vol. 15, No. 6, February 12, 2007, top 20 most downloaded articles, Appl. Phys. Lett., February 2007.
87. Chung-Ping Li, Chia-Hao Wu, Kung-Hwa Wei, Jeng-Tzong Sheu, J. Y. Huang, U-Ser Jeng and Keng S. Liang: "The Effect of Nanoscale Confinement on the Collective Electron Transport Behavior in Au Nanoparticles Self-Assembled in a Nanostructured Poly(styrene-b-4-vinylpyridine) Diblock Copolymer Ultra Thin Film" Advanced Functional Materials 17, 2283-2290, 2007.
88. Yu-Ting Lin and Chih Chen, Jia-Min Shieh and Ci-Ling Pan, "Stability of continuous-wave laser-crystallized epi-like silicon transistors," Appl. Phys. Lett. Vol. 30, art. 073508, February 16, 2007.
89. Gong-Ru Lin, Chi-Kuan Lin, and Chun-Jung Lin, "Enhanced Fowler-Nordheim Tunneling Effect in a Nanocrystallite Si Based LED with Interfacial Si Nano-pyramids", Optics Express, Vol. 15, No. 5, pp. 2555-2563, March 2007.
90. Gong-Ru Lin, Ying-Tsung Lin, and Chao-Kuei Lee, "Simultaneous pulse amplification and compression in

all-fiber-integrated pre-chirped large-mode-area Er-doped fiber amplifier", Optics Express, Vol. 15, Issue 6, pp. 2993-2999, March 2007.

91. Gong-Ru Lin, Chun-Jung Lin, Hao-Chung Kuo, Huang-Sheng Lin, and Chi-Chiang Kao,"Anomalous microphotoluminescence of high-aspect-ratio Si nanopillars formatted by dry-etching Si substrate with self-aggregated Ni nanodot mask", Applied Physics Letters, Vol. 90, No. 14, 143102, April 2007.
92. Gong-Ru Lin, Chun-Jung Lin, and Ya-Chung Chang, "Optical characterization of CO2-laser-ablated Si-rich SiOx", Applied Physics Letters, Vol. 90, No. 15, 151903, April 2007.
93. Kuang Yao Lo, Yi Jen Huang, Jung Y. Huang, Zhe Chuan Feng, William E. Fenwick, Ming Pan and Ian T. Ferguson: "Reflective Second Harmonic Generation from ZnO thin films: a study on the Zn-O bonding " Appl. Phys. Lett. 90, Issue 16, 161904, 2007.
94. Gong-Ru Lin, Yia-Chung Chang, En-Shao Liu, Hao-Chung Kuo, and Huang-Shen Lin,"Low-Refractive-Index Si Nano-pillars on Si Substrate," Applied Physics Letters, Vol. 90, No. 18, 181923, April 2007.
95. Hung-Wen Chen, Yu-Tai Li, Ci-Ling Pan, Jeng-Liang Kuo, Ja-Yu Lu, Li-Jin Chen, and Chi-Kuang Sun, "Investigation on spectral loss characteristics of subwavelength terahertz fibers," Opt. Lett. Vol. 32, No. 9, pp. 1017-1019, May 2007.
96. Yu-Tai Li, J.-W. Shi, Ci-Ling Pan, C.-H. Chiu, W.- S. Liu, C. -K. Sun, and J. -I. Chyi, "Sub- THz Photonic-Transmitters Based on Separated- Transport- Recombination Photodiode and Micromachined Slots Antenna," IEEE Photon. Technol. Lett., Vol. 19, No. 11 pp. 840-842, June 1, 2007.
97. Gong-Ru Lin and Chun-Jung Lin, "Enhancing Nanocrystallite Si Electroluminescence by Suppressing Oxygen Decomposition in High Temperature and Low Plasma Power PECVD", Journal of Electrochemistry Society, Vol. 154, No. 8, pp. H743-748, June 2007.
98. Yi-Chao Wang, Jia-Min Shieh, Hsiao-Wen Zan and Ci-Ling Pan, "Near-infrared femtosecond laser crystallized poly-Si thin film transistors," Opt. Exp., Vol. 15, No. 11, pp. 6981-6986, May 28, 2007, selected by Virtual Journal of Ultrafast Sciences, Vol . 6, No. 7, July 2007.
99. Gong-Ru Lin, Yu-Sheng Liao, and Kun-Chieh Yu, "All-optical decision-gating of 10Gbit/s return-to-zero data by temporally narrowing the gain-window in a semiconductor optical amplifier", IEEE/OSA Journal of Lightwave Technology, Vol. 25, No. 7, pp. 1651-1658, July 2007.
100. Gong-Ru Lin and Chia-Yang Chen, "Enhanced Pumping Energy Transfer between Si Nanocrystals and Erbium Ions in Si-rich SiOx Sputtered Using Si/Er2O3 Encapsulated SiO Substrate", Journal of Nanoscience and Nanotechnology, Vol. 7, No. 8, pp. 2841-2847, July 2007.
101. Shao-Ju Chang, Kuen-Yi Wu, Ya-Hsin Yang, Jenn-Chang Hwang, Hsin-Ying Wu, Ru-Pin Pan, An-Ping Lee and Chwung-Shan Kou, "Liquid crystal alignment on the a-C:H films by Ar plasma ion immersion", Thin Solid Films, Vol. 515, Issue 20-21, pp.8000-8004, 31 July 2007.
102. Hsin-Ying Wu and Ru-Pin Pan, "Liquid crystal surface alignments by using ion beam sputtered magnetic thin films" Appl. Phys. Letts, Vol. 91, art. 074102, 13 Aug. 2007.
103. Gong-Ru Lin and Chun-Jung Lin, "A CO2 laser rapid-thermal-annealing SiOx based metal-oxide-semiconductor light emitting diode", Applied Physics Letters, Vol. 91, No. 7, 072103, August 2007.
104. Gong-Ru Lin, Chun-Jung Lin, and Hao-Chung Kuo,"Silicon nano-pillar array enhanced Fowler-Nordheim tunneling in a silicon nanocrystal based metal-oxide-semiconductor light emitting diode", Applied Physics Letters, Vol. 92, No. 9, 093122, August 2007.
105. H. Ahn, C.-H. Chuang, Y.-C. Wang,Y.-P. Ku, S. Gwo and Ci-Ling Pan, "Terahertz Emission from Vertically Aligned InN Nanorod Arrays," Appl. Phys. Lett. Vol. 91, art. 132108, September 27, 2007.
106. Ru-Pin Pan, Chia-Rong Sheu, Yu-Ping Lan, Yi-Fan Lai and Ci-Ling Pan, "Liquid Crystal Enabled Multi-channel Power Equalizer and Stabilizer," Optics Comm., Vol. 278, Issue 2, pp. 329-333, 15 October, 2007.
107. C. Y. Kang, C. H. Chao, S. C. Shiu, L. J. Chou, M. T. Chang, Gong-Ru Lin, and C.-F. Lin, "Formation of self-organized platinum nanoparticles and their microphotoluminescence enhancement in the visible light region," Journal of Applied Physics, Vol. 102, No. 7, Art. No. 073508, October 2007.
108. Gong-Ru Lin, C.-J. Lin, and C.-T. Lin, "Low-plasma and high-temperature PECVD grown silicon-rich SiOx film

with enhanced carrier tunneling and light emission," Nanotechnology, Vol. 18, No. 39, Art. No. 395202, October 2007.

109. H. Ahn, Y.-P. Ku, Y.-C. Wang, C.-H. Chuang, S. Gwo, and Ci-Ling Pan, "Terahertz Spectroscopic studies of Vertically-Aligned InN Nanorod Arrays," Appl. Phys. Lett., Vol. 91, art. 163105, 15 October 2007.
110. Gong-Ru Lin, Ci-Ling Pan and Kun-Chieh Yu, "Dynamic chirp control of all-optical format-converted pulsed data from a multi-wavelength inverse-optical-comb injected semiconductor optical amplifier," Opt. Exp., Vol. 15, Issue 20, pp. 13330-13339, 1 October 2007.
111. V. V. Meriakri, I. P.Nikitin, Ci-Ling Pan, Ru-Pin Chao Pan, M. P. Parkhomenko, E. E.Chigrai, "Methods and Results of Investigating the Dielectric Properties of Liquid Crystals in the Millimeter Wave Band," submitted to Telecommunications and Radio Engineering, http://www.begellhouse.com/journals/0632a9d54950b268.html, Oct. 31, 2007.
112. Gong-Ru Lin; Ci-Ling Pan; Ying-Tsung Lin, "Self-Steepening of Prechirped Amplified and Compressed 29-fs Fiber Laser Pulse in Large-Mode-Area Erbium-Doped Fiber Amplifier," Journal of Lightwave Technology, Vol. 25, No. 11, pp. 3597 – 3601, Nov. 2007.
113. Gong-Ru Lin, C.-L. Pan and Ying-Tsung Lin, "The Effect of Large-mode-Field-Area Erbium-Doped Fiber on Pre-Chirped Femtosecond Amplification and Compression of Mode-Locked Fiber Laser Pulses", OSA/IEEE Journal of Lightwave Technology, Vol. 25, No. 11, pp. 3597-3601, November 2007.
114. Yi-Fan Huang, Surojit Chattopadhyay, Tze-An Liu, Ci-Ling Pan, Yu-Kuei Hsu, Yi-Jun Jen, Cheng-Yu Peng, Chih-Shan Lee, Yuan-Huei Chang, Hung-Chun Lo, Chih-Hsun Hsu, Kuei-Hsien Chen, Li-Chyong Chen, "Improved broadband and quasiomnidirectional anti-reflection properties with biomimetic silicon nanostructures," Nature Nanotechnology, Vol. 2, pp. 770-774, December 2007.
115. Gong-Ru Lin, Ci-Ling Pan and Kun-Chieh Yu, "Dynamic chirp control of all-optical format-converted pulsed data from a multi-wavelength inverse-optical-comb injected semiconductor optical amplifier," Opt. Exp., Vol. 15, Issue 20, pp. 13330-13339, 1 October 2007, selected by Virtual Journal of Ultrafast Science Vol. 6, No. 12, December 2007.
116. Gong-Ru Lin, Kun-Chieh Yu, Ci-Ling Pan and Yu-Sheng Liao, "All-Optical Decision-Gating of 10-Gb/s RZ Data in a Semiconductor Optical Amplifier Temporally Gain-Shaped With Dark-Optical-Comb," Journal of Lightwave Technology, Vol. 25, No. 7, pp. 1651 – 1658, July 2007, selected by Virtual Journal of Ultrafast Science Vol. 6, No. 12, December 2007.
117. Jia-Min Shieh, Chih Chen and Yu-Ting Lin, Ci-Ling Pan, "Enhanced green laser-activation by anti-reflective gate structures in panel transistors," Appl. Phys. Lett., Vol. 92, art. 063503, 11 February 2008.
118. Ja-Yu Lu, Chin-Ping Yu, Hung-Chung Chang, Hung-Wen Chen, Yu-Tai Li, Ci-Ling Pan, and Chi-Kuang Sun, "Terahertz air-core microstructure fiber," Appl. Phys. Lett. Vol. 92, art. 064105, 11 February 2008.
119. Ja-Yu Lu, Chung-Chiu Kuo, Chui-Min Chiu, Hung-Wen Chen, Yuh-Jing Hwang, Ci-Ling Pan, and Chi-Kuang Sun, "THz interferomertric imaging using subwavelength plastic fiber based THz endoscope," Opt. Exp., Vol. 16, No. 4, pp. 2494-2501, 18 February 2008.
120. Ja-Yu Lu, Chui-Min Chiu, Chung-Chiu Kuo, Chih-Hsien Lai, and Hung-Chung Chang, Yuh-Jing Hwang, Ci-Ling Pan, and Chi-Kuang Sun, "Terahertz scanning imaging with a subwavelength plastic fiber," Appl. Phys. Lett., Vol. 92, art. 084102, 25 February 2008.
121. Chia-Jen Lin,Yu-Tai Li, Cho-Fan Hsieh, Ru-Pin Pan, and Ci-Ling Pan, "Manipulating Terahertz Wave by a Magnetically Tunable Liquid Crystal Phase Grating," Opt. Exp., Vol. 16, No. 5, pp. 2995-3001, 3 March 2008.
122. Tzu-Ming Liu, Ja-Yu Lu, Hung-Ping Chen, Chung-Chiu Kuo, Meng-JuYang, Chih-Wei Lai, Pi-Tai Chou, Ming-Hao Chang, Hsiang-Lin Liu, Yu-Tai Li, Ci-Ling Pan, Shih-Hung Lin, Chieh-Hsiung Kuan, and Chi-Kuang Sun, "Resonance-enhanced dipolar interaction between terahertz photons and confined acoustic phonons in nanocrystals," Appl. Phys. Lett., Vol. 92, art. 093122, 3 March 2008.
123. H. Ahn, Y.-P. Ku, and C.-H. Chuang, and Ci-Ling Pan, H.-W. Lin, Y.-L. Hong, and S. Gwo, "Intense terahertz emission from α-plane-grown InN surface," Appl. Phys. Lett., Vol. 92, art. 102103, 10 March 2008.
124. Wei-Jan Chen, Jhi-Ming Hsieh, Shu Wei Huang, Hao-Yu Su, Chien-Jen Lai, Tsung-Ta Tang, Chuan-Hsien Lin,

Chao-Kuei Lee, Ru-Pin Pan, Ci-Ling Pan, and A. H. Kung, “Sub-Single-Cycle Optical Pulse Train with Constant Carrier Envelope Phase,” Phys. Rev. Lett., Vol. 100, art. 163906, April 25, 2008.

125. Ru-Pin Pan, Cho-Fan Hsieh, Ci-Ling Pan, and Chao Yuan Chen, “Temperature-dependent optical constants and birefringence of nematic liquid crystal 5CB in the terahertz frequency range,” J. App. Phys., Vol. 103, No. 9, art. 093523, 1 May 2008.

B. Quantum (Photonic Crystal) structures and Enabling devices

1. Min-Feng Chang, Po-Tsung Lee, S. P. McAlister, and Albert Chin, "Low Sub-threshold Swing HfLaO/Pentacene Organic Thin Film Transistors," *IEEE Electron Device Lett.* 29, pp.215-217 (2008) (SCI IF:2.716)
2. C. H. Chiu, T. C. Lu, H. W. Huang, C. F. Lai, C. C. Kao, J. T. Chu, C. C. Yu, H. C. Kuo, and S. C. Wang, C. F. Lin, T. H. Shueh, “Fabrication of InGaN/GaN MQW nanorods LED by ICP-RIE and PEC oxidation process with self-assembly Ni metal islands”, Nanotechnology, V18, N.44, p445201, Nov. 7, 2007
3. Tien-Chang Lu, Tsung-Ting Kao, Chih-Chiang Kao, Jung-Tang Chu, Kang-Fan Yeh, Li-Fan Lin, Yu-Chun Peng, Hung-Wen Huang, Hao-Chung Kuo, and Shing-Chung Wang “GaN-Based High-Q Vertical-cavity Light Emitting Diodes”, IEEE Electron. Device Lett., V28, N10, pp884, Oct., 2007
4. Shing-Chung Wang, Tien-Chang Lu, Chih-Chiang Kao, Jong-Tang Chu, Gen-Sheng Huang, Hao-Chung Kuo, Shih-Wei Chen, Tsung-Ting Kao, Jun-Rong Chen, and Li-Fan Lin, “Optically Pumped GaN-based Vertical Cavity Surface Emitting Lasers: Technology and Characteristics”, Jpn. J. Appl. Phys., V46, No. 8B, pp5397-5407, Aug. 23, 2007
5. C. H. Chiu, M. H. Lo, C. F. Lai, T. C. Lu, Y. A. Chang, H. W. Huang, H. C. Kuo, S. C. Wang, C. F. Lin, and Y. K. Kuo, “Optical properties of high Indium $In_{0.3}Ga_{0.7}N$/GaN MQW green nanorods by plasma etching with nanoscale nickel metal islands”, Nanotechnology, V18, N33, p335706, Aug. 23, 2007
6. C. E. Lee, Y. J. Lee, H. C. Kuo, M. R. Tsai, B. S. Cheng, T. C. Lu, S. C. Wang, C. T. Kuo, “Enhancement of Flip-Chip Light-Emitting Diodes With Omni-Directional Reflector and Textured Micropillar Arrays”, IEEE Photon. Tech. Lett., V19, No16, pp1200-1202, Aug. 15, 2007
7. Chun-Feng Lai, Peichen Yu, Te-Chung Wang, Hao-Chung Kuo, Tien-Chang Lu, Shing-Chung Wang and Chao-Kuei Lee “Lasing Characteristics of a GaN Photonic Crystal Nanocavity Light Source”, Appl. Phys. Lett., V91, 041101, Jul. 23, 2007
8. T. S. Ko, C. P. Chu, T. C. Lu, H. C. Kuo, and S. C. Wang “Synthesis of In_2O_3 nanocrystal chains and annealing effect on their optical properties”, J. Vac. Sci. Technol. A, V25, pp1038-1041 ,Jul 2, 2007
9. Y.C. Lee, H.C. Kuo, C.E. Lee, J.R. Chen, Y.A. Chang, T.C. Lu, S.C. Wang, and S.W. Chiou, “High Temperature Stability of 650-nm Resonant-Cavity Light-Emitting Diodes Fabricated Using Wafer Bonding Technique on Silicon Substrates”, IEEE Photon. Tech. Lett., V19, No14, pp1060-1062, Jul 15, 2007
10. Hou-Guang Chen, T. S. Ko, Tien-Chang Lu, Hao-Chung Kuo and Shing-Chung Wang, Li Chang, “Dislocation reduction in non-polar GaN grown on stripe patterned r-plane sapphire substrates”, Appl. Phys. Lett., V91, 021914, Jul. 9, 2007
11. G. S. Huang, T. C. Lu, H. C. Kuo and S. C. Wang and Hou-Guang Chen,“Fabrication of hybrid nitride microcavity with high quality factor using highly reflective AlN/GaN and Ta_2O_5/SiO_2 distributed Bragg mirrors”, IEEE Photon. Tech. Lett., V19, No13, pp999-pp1001, July 1, 2007
12. G. S. Huang, H. C. Kuo, M. H. Lo, T. C. Lu, S. C. Wang, and J. Y. Tsai, “Improvement of efficiency and ESD characteristics of ultraviolet light emitting diodes by inserting AlGaN and SiN buffer layers”, J. Crystal Growth, V305, pp55-58, July 1, 2007
13. C. H. Chiu, H.C. Kuo, C. E. Lee, C. H. Lin, P.C. Cheng, H. W. Huang, T.C. Lu, S. C. Wang, and K. M. Leung, “Fabrication and Characteristics of thin-film InGaN–GaN light-emitting diodes with an TiO_2/SiO_2 omnidirectional reflector”, Semicon. Sci. Tech, V22, p831-835, Jun. 21, 2007
14. Chih-Chiang Kao, Kang-Fan Yeh, Jong-Tung Chu, Wei-Lun Peng, Hung-Wen Huang, Tien-Chang Lu, Hao-Chung Kuo and Shing-Chung Wang, “Light-Output Enhancement of Nano-Roughened GaN Laser Lift-off

Light-Emitting Diodes Formed by ICP Dry Etching", IEEE Photon. Tech. Lett., V19, N11, p849, Jun. 1, 2007

15. Y. J. Lee, T.C. Lu, H.C. Kuo, and S.C. Wang, "High Brightness GaN-based Light Emitting Diodes", IEEE J. Display Technol. V3, No2, pp118-125, June, 2007
16. T. S. Ko, T. C. Wang, R. C. Gao, H. G. Chen, G. S. Huang, T. C. Lu*, H. C. Kuo, and S. C. Wang "Observations on surface morphologies and dislocations of a-plane GaN grown by metal organic chemical vapor deposition", Phys. Stat. Sol. (c), V4, No. 7, pp2510-2514, May 31, 2007
17. T. Wang, T. Ko, H. Kuo, T. Lu, Min Yu, C. Chuo, and Z. Lee, "Optical and structural properties of a-plane GaN with epitaxial lateral overgrowth", Phys. Stat. Sol. (c), V4, No. 7, pp2519-2513, May 31, 2007
18. G. S. Huang, Hou-Guang Chen, J. J. Chen, T. C. Lu, H. C. Kuo, and S. C. Wang, "Hybrid nitride microcavity using crack-free highly reflective AlN/GaN and Ta_2O_5/SiO_2 distributed Bragg mirror", Phys. Stat. Sol. (a), V204, No. 6, pp1977-1981, May 15, 2007
19. T. S. Ko, T. C. Lu, T. C. Wang, M. H. Lo, J. R. Chen, R. C. Gao, H. C. Kuo, S. C. Wang "Optical characteristics of a-plane InGaN multiple quantum wells with different well width", Appl. Phys. Lett., V90, 181122, Apr. 30, 2007.
20. Po-Tsung Lee, Tsan-Wen Lu, Chia-Min Yu, and Chung-Chuan Tseng, "Photonic crystal circular-shaped microcavity and its uniform cavity-waveguide coupling property due to presentation of whispering gallery mode," *Opt. Express* 15, pp. 9450-9457 (2007) (SCI IF:4.009)
21. John D. O'Brien, Wan Kuang, Jiang-Rong Cao, Min-Hsiung Shih, Po-Tsung Lee, Mahmood Bagheri, Adam Mock, and W. K. Marshall, "Photonic crystal microcavity lasers," *J. Phys. D: Appl. Phys.* 40, 2671 (2007) (invited) (SCI IF: 2.077)
22. Po-Tsung Lee, Tsan-Wen Lu, Jyun-Hao Fan, and Feng-Mao Tsai, "High quality factor microcavity lasers realized by circular photonic crystal with isotropic photonic bandgap effect," *Appl. Phys. Lett.* 90, 151125 (2007) (SCI IF:4.127) (Selected for *Virtual Journal of Nanoscale Science & Technology,* Vol. 15, issue 17, Apr. 30, 2007)
23. Po-Tsung Lee, Tsan-Wen Lu, and Feng-Mao Tsai, "Octagonal Quasi-Photonic Crystal Single-Defect Micro-cavity with Whispering Gallery Mode and Condensed Device Size," *IEEE Photon. Technol. Lett.* 19, pp. 710-712 (2007) (SCI IF:2.266)
24. Po-Tsung Lee, Tsan-Wen Lu, Feng-Mao Tsai, and Tien-Chang Lu, "Lasing Action of Octagonal Quasi-Periodic Photonic Crystal Micro-Cavity," *J. Jpn. Appl. Phys.* 46, pp. 971-973 (2007) (SCI IF:1.096)
25. Hou-Guang Chen, Nai-Fang Hsu, Hsin-Hung Yao, Jung-Tang Chu, Tien-Chang Lu, Hao-Chung Kuo and Shing-Chung Wang, "Strong Ultraviolet Emission from InGaN/AlGaN Multi Quantum Well Grown by Multi-step Process", Jpn. J. Appl. Phys., Vol. 46, No. 4B, pp. 2574-2577 ,Apr. 24, 2007
26. Yea-Chen Lee, Chia-En Lee, Bo-Siao Cheng, Tien-Chang Lu, Hao-Chung Kuo, Shing-Chung Wang, and Shu-Woei Chiou, "High Performances of 650 nm Resonant Cavity Light Emitting Diodes for Plastic Optical Fiber Application", Jpn. J. Appl. Phys., Vol. 46, No. 4B, pp. 2450-2453, Apr. 24, 2007
27. Y. J. Lee, P.C. Lin, T.C. Lu, H.C. Kuo, and S.C. Wang, "Dichromatic InGaN-based white light-emitting-diodes by using laser lift-off and wafer-bonding scheme", Appl. Phys. Lett., V90, 161115, Apr. 18, 2007
28. H. W. Huang, H. C. Kuo, C. F. Lai, C. E. Lee, C. W. Chiu, T. C. Lu, S. C. Wang, C. H. Lin, and K. M. Leung "High performance GaN-based vertical-injection light-emitting diodes with TiO_2/SiO_2 omni-directional reflector and n-GaN roughness", V19, Issue 18, pp565-567, IEEE Photon. Tech. Lett, Apr. 15, 2007
29. Y. J. Lee, T. C. Lu, H.C. Kuo, S.C. Wang, T. C. Hsu, M. H. Hsieh, M. J. Jou, and B. J. Lee, "Nano-roughening n-side surface of AlGaInP-based LEDs for increasing extraction efficiency", Materials Science and Engineering: B, V138, No2, pp157-160, March 25, 2007
30. P. T. Lee, T. W. Lu, F. M. Tsai, and T. C. Lu, "Lasing Action of Octagonal Quasi-Periodic Photonic Crystal Microcavity," Jpn. J. Appl. Phys., V46, No. 3A, pp971 -973, Mar. 8, 2007
31. G.S. Huang, T. C. Lu, H. H. Yao, H.C. Kuo, S. C. Wang, Greg Sun, Chih-wei Lin, and Li Chang, "Fabrication and characterization of active region of a terahertz GaN/AlGaN quantum cascade laser", J. Crystal Growth, V298, pp687-690,Feb. 2007
32. Hung-Wen Huang, Chih-Chiang Kao, Jung-Tang Chu, Wei-Chih Wang, Tien-Chang Lu, Hao-Chung Kuo, Shing-Chung Wang, and Chang-Chin Yu, "Investigation of InGaN/GaN Light Emitting Diodes with

Nano-roughened surface by Excimer Laser Etching Method", Materials Science and Engineering: B, V136, pp182-186, Jan, 25, 2007

33. T. S. Ko, T. C. Wang, R. C. Gao, H. G. Chen, G. S. Huang, T. C. Lu*, H. C. Kuo, and S. C. Wang "Study on optimal growth condition of a-plane GaN grown on r-plane sapphire by MOCVD", J. Crystal Growth, V300, p303-313, Jan. 20, 2007
34. T. S. Ko, T. C. Wang, H. G. Chen, R. C. Gao, Y. J. Lee, T. C. Lu, H. C. Kuo, and S. C. Wan, "InGaN/GaN Nano-stripe Grown on Pattern Sapphire by Metal Organic Chemical Vapor Deposition", Appl. Phys. Lett., V90, 013110, Jan, 1, 2007
35. H.C. Kuo , W.C. Chen, F.I. Lai , C.P. Cheng , H.C. Kuo , S.C. Wang , W.F. Hsieh , "Effects of doping concentration and annealing temperature on properties of highly-oriented al-doped ZnO films," Journal of Crystal Growth Vol287, no(1),PP. 78-84 JAN 18 2006
36. T.C. Wang , H.C. Kuo , Z.H. Lee , C.C. Chuo , M.Y. Tsai , C.E. Tsai , T.D. Lee , T.C. Lu , J. Chi ," Quaternary AlInGaN multiple quantum well 368 nm light-emitting diode," Journal of Crystal Growth Vol287,no (2),pp. 582-585 JAN 25 2006
37. Y.A. Chang , J.T. Chu , C.T. Ko , H.C. Kuo , C.F. Lin , S.C. Wang ," MOCVD growth of highly strained 1.3 mu m InGaAs : Sb/GaAs vertical cavity surface emitting laser," Journal of Crystal Growth Vol287,no (2),pp. 550-553 JAN 25 2006
38. I.L. Chen , W.C. Hsu, T.D. Lee , H.C. Kuo , K.H. Su , C.H. Chiou , J.M. Wang , Y.H. Chang ," Growth of highly strained RnGaAs quantum wells by metalorganic chemical vapor deposition with application to vertical-cavity surface-emitting laser," Japanese Journal of Applied Physics Vol45,no (1-3),pp. L54-L56 JAN 2006
39. Y.A. Chang , J.R. Chen , H.C. Kuo , Y.K. Kuo , S.C. Wang ," Theoretical and experimental analysis on InAlGaAs/AlGaAs active region of 850-nm vertical-cavity surface-emitting lasers," Journal of Lightwave Technology Vol24,no(1),pp. 536-543 JAN 2006
40. G.S. Huang , T.C. Lu , H.H. Yao , H.C. Kuo, S.C. Wang , C.W. Lin , L.Chang," Crack-free GaN/AlN distributed Bragg reflectors incorporated with GaN/AlN superlattices grown by metalorganic chemical vapor deposition," Applied Phycics Letters Vol88,no (6),pp.061904 FEB 6 2006
41. C.J. Lin , C.K. Lin , C.W. Chang , Y.L. Chueh , H.C. Kuo , E.W.G. Diau , L.J. Chou, G.R. Lin ," Photoluminescence of plasma enhanced chemical vapor deposition amorphous silicon oxide with silicon nanocrystals grown at different fluence ratios and substrate temperatures," Japanese Journal of Applied Physics Vol.45 ,no.(2A),pp.1040-1043 FEB 2006
42. I.L. Chen , W.C. Hsu , H.C. Kuo , C.P. Sung , C.H. Chiou , J.M. Wang , Y.H. Chang , H.C. Yu , Lee TD," Effect of annealing on low-threshold-current large-wavelength InGaAs quantum well vertical-cavity laser," Japanese Journal of Applied Physics ,Vol.45,no. (2A),pp. 770-773 FEB 2006
43. Y.J. Lee , T.C. Lu, H.C. Kuo , S.C. Wang , M.J. Liou , C.W. Chang , T.C. Hsu , M.H. Hsieh , M.J. Jou , B.J. Lee ," AlGaInP light-emitting diodes with stripe patterned omni-directional reflector," Japanese Journal of Applied Physics ,Vol.45,no.(2A),pp. 643-645 FEB 2006
44. H.C. Yu , J.S. Wang , Y.K. Su , S.J. Chang , F.I. Lai , Y.H. Chang , H.C. Kuo , C.P. Sung , H.P.D. Yang , K.F. Lin , J.M. Wang , J.Y. Chi , R.S. Hsiao , S .Mikhrin ," 1.3-mu m InAs-InGaAs quantum-dot vertical-cavity surface-emitting laser with fully doped DBRs grown by MBE," IEEE Photonics Technology Letters,Vol.18,no.(1-4),pp.418-420 JAN-FEB 2006
45. Y.J. Lee , T.C. Lu , H.C. Kuo , S.C. Wang , M.J. Liou , C.W. Chang , T.C. Hsu , M.H. Hsieh , M.J. Jou , B.J. Lee ," High brightness AlGaInP-based light emitting diodes by adopting the stripe-patterned omni-directional reflector," Semiconductor Science and Technology,Vol.21,no. (2),pp. 184-189 FEB 2006
46. C.H. Lin , J.Y. Tsai ,C.C. Kao , H.C. Kuo , C.C. Yu , J.R. Lo , K.M. Leung ," Enhanced light output in InGaN-based light-emitting diodes with onmidirectional one-dimensional photonic crystals," Japanese Journal of Applied Physics,Vol.45,no. (3A),pp.1591-1593 MAR 2006
47. H.W. Huang , C.C. Kao , Y.A. Chang , H.C. Kuo , L.H. Laih , S.C. Wang ," A novel method to improve VCSELs oxide-confined aperture uniformity using selective As+-implanted underlying layer," Materials Chemistry and

Physics,Vol.97,no. (1),pp. 10-13 MAY 10 2006

48. P.C. Peng , H.C. Kuo , W.K. Tsai , Y.H. Chang , C.T. Lin , S. Chi , S.C. Wang ," Dynamic characteristics of long-wavelength quantum dot vertical-cavity surface-emitting lasers with light injection," Optics Express,Vol.14,no. (7),pp. 2944-2949 APR 3 2006
49. H.H. Yao, T.C. Lu, G.S. Huang, C.Y. Chen, W.D. Liang, H.C. Kuo, S.C. Wang," InGaN self-assembled quantum dots grown by metal-organic chemical vapour deposition with growth interruption," Nanotechnology 17 (6): 1713-1716 MAR 28 2006
50. C.C. Kao, T.C. Lu, H.W. Huang, J.T. Chu, Y.C. Peng, H.H. Yao, J.Y. Tsai, T.T. Kao, H.C. Kuo, S.C. Wang, C.F. Lin," The lasing characteristics of GaN-based vertical-cavity surface-emitting laser with AlN-GaN and Ta2O5-SiO2 distributed Bragg reflectors" IEEE Photonics Technology Letters 18 (5-8): 877-879 MAR-APR 2006
51. Y.H. Chang, P.C. Peng, W.K. Tsai, G. Lin, F. Lai, R.S. Hsiao, H.P. Yang, H.C. Yu, K.F. Lin, J.Y. Chi, S.C. Wang, H.C. Kuo," Single-mode monolithic quantum-dot VCSEL in 1.3 mu m with sidemode suppression ratio over 30 dB" IEEE Photonics Technology Letters 18 (5-8): 847-849 MAR-APR 2006
52. Y.J. Lee, J.M. Hwang, T.C. Hsu, M.H. Hsieh, M.J. Jou, B.J. Lee, T.C. Lu, H.C. Kuo, S.C. Wang," GaN-based LEDs with Al-deposited V-shaped sapphire facet mirror" IEEE Photonics Technology Letters 18 (5-8): 724-726 MAR-APR 2006
53. J.T. Chu, T.C. Lu, H.H. Yao, C.C. Kao, W.D. Liang, J.Y. Tsai, H.C. Kuo, S.C. Wang," Room-temperature operation of optically pumped blue-violet GaN-based vertical-cavity surface-emitting lasers fabricated by laser lift-off" Japanese Journal of Applied Physics 45 (4A): 2556-2560 APR 2006
54. S.Y. Kuo, F.I. Lai , W.C. Chen, C.P. Cheng, H.C. Kuo, S.C. Wang," Ultraviolet lasing of sol-gel-derived zinc oxide polycrystalline films" Japanese Journal of Applied Physics 45 (4B): 3662-3665 APR 2006
55. T.C. Wang, H.C. Kuo, T.C. Lu, C.E. Tsai, M.Y. Tsai, J.T. Hsu, J.R. Yang," Study of InGaN multiple quantum dots by metal organic chemical vapor deposition" Japanese Journal of Applied Physics 45 (4B): 3560-3563 APR 2006
56. Y.C. Peng, C.C. Kao, H.W. Huang, J.T. Chu, T.C. Lu, H.C. Kuo, S.C. Wang, C.C. Yu," Fabrication and characteristics of GaN-based microcavity light-emitting diodes with high reflectivity AIN/GaN distributed Bragg reflectors" Japanese Journal of Applied Physics 45 (4B): 3446-3448 APR 2006
57. H.W. Huang, J.T. Chu, C.C. Kao, T.H. Hsueh, T.C. Lu, H.C. Kuo, S.C. Wang, C.C. Yu, S.Y. Kuo," Enhanced light output in InGaN/GaN light emitting diodes with excimer laser etching surfaces" Japanese Journal of Applied Physics 45 (4B): 3442-3445 APR 2006
58. P.T. Lee, T.W. Lu, F.M. Tsai, T.C. Lu, H.C. Kuo," Whispering gallery mode of modified octagonal quasiperiodic photonic crystal single-defect microcavity and its side-mode reduction" Applied Physics Letters 88 (20): Art. No. 201104 MAY 15 2006
59. SY Kuo, CC Kei, CN Hsiao, CK Chao, FI Lai, HC Kuo, WF Hsieh, SC Wang," Catalyst-free GaN nanorods grown by metalorganic molecular beam epitaxy" IEEE Transactions on Nanotechnology 5 (3): 273-277 MAY 2006
60. YA Chang, SH Yen, TC Wang, HC Kuo, YK Kuo, TC Lu, SC Wang," Experimental and theoretical analysis on ultraviolet 370 nm AlGaInN light-emitting diodes" Semiconductor Science and Technology 21 (5): 598-603 MAY 2006
61. GS Huang, HH Yao, TC Lu, HC Kuo, SC Wang," Aluminum incorporation into AlGaN grown by low-pressure metal organic vapor phase epitaxy" Journal of Applied Physics 99 (10): Art. No. 104901 MAY 15 2006
62. FI Lai, SY Kuo, JS Wang, RS Hsiao, HC Kuo, J Chi, SC Wang, HS Wang, CT Liang, YF Chen," Temperature-dependent optical properties of In0.34Ga0.66As1-xNx/GaAs single quantum well with high nitrogen content for 1.55 mu m application grown by molecular beam epitaxy" Journal of Crystal Growth 291 (1): 27-33 MAY 15 2006
63. CK Lee, JH Hsu, DC Wang, YH Chang, HC Kuo, SC Wang," Optical properties of high density InGaN QDs grown by MOCVD" Materials Science & Engineering C-Biomimetic and Supramolecular Systems 26 (5-7): 975-978 Sp. Iss. SI, JUL 2006
64. HW Huang, HC Kuo, JT Chu, CF Lai, CC Kao, TC Lu, SC Wang, RJ Tsai, CC Yu, CF Lin," Nitride-based LEDs

with nano-scale textured sidewalls using natural lithography" Nanotechnology 17 (12): 2998-3001 JUN 28 2006

65. YS Liao, JW Shi, YS Wu, HC Kuo, M Feng, GR Lin," Optically heterodyne diagnosis of a high-saturation-power undoped InP sandwiched InGaAs p-i-n photodiode grown on GaAs" Optics Express 14 (12): 5031-5037 JUN 12 2006
66. YJ Lee, JM Hwang, TC Hsu, MH Hsieh, MJ Jou, BJ Lee, TC Lu, HC Kuo, SC Wang," Enhancing the output power of GaN-based LEDs grown on wet-etched patterned sapphire substrates" IEEE Photonics Technology Letters 18 (9-12): 1152-1154 MAY-JUN 2006
67. PC Peng, WR Peng, KM Feng, HY Chiou, J Chen, HC Kuo, SC Wang, S Chi," OCDMA light source using directly modulated Fabry-Perot laser diode in an external injection scheme" IEEE Photonics Technology Letters 18 (9-12): 1103-1105 MAY-JUN 2006
68. FI Lai, SY Kuo, YH Chang, HW Huang, CW Chang, CC Yu, CF Lin, HC Kuo, SC Wang," Fabrication of magnesium-doped gallium nitride nanorods and microphotoluminescence characteristics" Journal of Vacuum Science & Technology B 24 (3): 1123-1126 MAY-JUN 2006
69. TS Ko, CP Chu, HG Chen, TC Lu, HC Kuo, SC Wang," Observation of strong red photoluminescence with broadband in indium oxynitride nanoparticles" J Journal of Vacuum Science & Technology A 24 (4): 1332-1335 JUL-AUG 2006
70. FI Lai, SY Kuo, JS Wang, HC Kuo, SC Wang, HS Wang, CT Liang, YF Chen," Effect of nitrogen contents on the temperature dependence of photoluminescence in InGaAsN/GaAs single quantum wells" Journal of Vacuum Science & Technology A 24 (4): 1223-1227 JUL-AUG 2006
71. GR Lin, K HC uo, HS Lin, CC Kao," Rapid self-assembly of Ni nanodots on Si substrate covered by a less-adhesive and heat-accumulated SiO2 layers" Applied Physics Letters 89 (7): Art. No. 073108 AUG 14 2006
72. Po-Tsung Lee, Tsan-Wen Lu, Feng-Mao Tsai, and Tien-Chang Lu, "Investigation of whispering gallery mode dependence on cavity geometry of quasiperiodic photonic crystal microcavity lasers," *Appl. Phys. Lett.* 89, 231111 (2006) (SCI IF:4.127)
73. Po-Tsung Lee, Tsan-Wen Lu, Feng-Mao Tsai, Tien-Chang Lu, and Hao-Chung Kuo, "Whispering gallery mode of modified octagonal quasi-periodic photonic crystal single defect microcavity and its side mode reduction," *Appl. Phys. Lett.* 88, 201104 (2006) (SCI IF:4.127)
74. HW Huang, JT Chu, TH Hsueh, MC Ou-Yang, HC Kuo, SC Wang," Fabrication and photoluminescence of InGaN-based nanorods fabricated by plasma etching with nanoscale nickel metal islands" Journal of Vacuum Science & Technology B 24 (4): 1909-1912 JUL-AUG 2006
75. C. C. Kao, H. C. Kuo, H. W. Huang, J. T. Chu, Y. C. Peng, Y. L. Hsieh, C. Y. Luo, S. C. Wang, C.C. Yu, C. F. Lin "Light-output enhancement in a nitride-based light-emitting diode with 22 degrees undercut sidewalls" IEEE Photonincs Technology Letters 17 (1): 19-21 JAN 2005(2)
76. . Kuo, Y. H. Chang, Y. A. Chang, F. I. Lai, J. T. Chu, M. N. Tsai, S. C. Wang "Single-mode 1.27-mu m InGaAs : Sb-GaAs-GaAsP quantum well vertical cavity surface emitting lasers" IEEE Journal of Selected Topics in Quantum Electronics 11 (1): 121-126 JAN-FEB 2005(0)
77. H. C. Kuo, Y. H., H. H. Yao, Y. A. Chang, F. I. Lai, M. Y. Tsai, S. C. Wang "High-speed modulation of InGaAs : Sb-GaAs-GaAsP quantum-well vertical-cavity surface-emitting lasers with 1.27-mu m emission wavelength" IEEE Photonincs Technology Letters 17 (3): 528-530 MAR 2005(0)
78. HPD Yang, F. I. Lai, Y. H. Chang, H. C. Yu,C. P. Sung, H. C. Kuo, S. C. Wang,S. Y. Lin, J. Y. Chi "Singlemode (SMSR > 40 dB) proton-implanted photonic crystal vertical-cavity surface-emitting lasers" Electronics Letters 41 (6): 326-328 MAR 17 2005(0)
79. H. W. Huang,C. C. Kao, J. I. Chu, H. C. Kuo, S. C. Wang, C. C. Yu "Improvement of InGaN-GaN light-emitting diode performance with a nano-roughened p-GaN surface" IEEE Photonincs Technology Letters 17 (5): 983-985 MAY 2005(0)
80. T. H. Hsueh,H. W.Huang, F. I. Lai, J. K. Sheu, Y. H. Chang, H. C. Kuo, S. C. Wang "Photoluminescence from In0.3Ga0.7N/GaN multiple-quantum-well nanorods" Nanotechnology 16 (4): 448-450 APR 2005(0)

81. T. H. Hsueh,H. W.Huang, C. C. Kao,Y. H. Chang, M. C. Ou-Yang, H. C. Kuo, S. C. Wang "Characterization of InGaN/GaN multiple quantum well nanorods fabricated by plasma etching with self-assembled nickel metal nanomasks" Japanese Journal of Applied Physics 44 (4B): 2661-2663 APR 2005(0)
82. Y. H. Chang, T. H. Hsueh, F. I. Lai, C. W. Chang, C. C. Yu,H.W. Huang, C. F. Lin, H. C. Kuo, S. C. Wang "Fabrication and micro-photoluminescence investigation of Mg-doped gallium nitride nanorods" Japanese Journal of Applied Physics 44 (4B): 2657-2660 APR 2005(0)
83. Y. H. Chang, H. C. Kuo, Y. A. Chang, J. T. Chu, M. Y. Tsai, S. C. Wang "10 Gbps InGaAs : Sb-G-aAs-GaAsP quantum well vertical cavity surface emitting lasers with 1.27 mu m emission wavelengths" Japanese Journal of Applied Physics (4B): 2556-2559 APR 2005(0)
84. J. T. Chu, H. W. Huang, C. C. Kao, W. D. Liang, F. I. Lai,C. F. Chu, H. C. Kuo, S. C. Wang "Fabrication of large-area GaN-based light-emitting diodes on Cu substrate" Apanese Journal of Applied Physics (4B): 2509-2511 APR 2005(2)
85. G. R. Lin, H. C. Kuo, C. K. Lin, M. Feng "Ultralow leakage In0.53Ga0.47As p-i-n photodetector grown on linearly graded metamorphic InxGa1-xP buffered GaAs substrate" EE Journal of Quantum Electronics 41 (6): 749-752 JUN 2005(0)
86. T. H. Hsueh, J. K. Shen, H. W. Huang, J. Y. Chu, C. C. Kao, H. C. Kuo, S. C. Wang "Enhancement in light output of InGaN-based microhole array light-emitting diodes" IEEE Photonics Technology Letters 17 (6): 1163-1165 JUN 2005(1)
87. Y. A. Chang, H. C. Kuo, C. Y. Lu, Y. K. Kuo, S. C. Wang "Improving high-temperature performance in continuous-wave mode InGaAsN/GaAsN ridge waveguide lasers" Semiconductor Science and Technology 20 (6): 601-605 JUN 2005(1)
88. Y. H. Chang, H. C. Kuo, F. I. Lai, K. F. Tzeng, H. C. Yu, C. P. Sung, H. P. Yang, S. C. Wang "High speed (> 13 GHz) modulation of 850 nm vertical cavity surface emitting lasers (VCSELs) with tapered oxide confined layer" IEE Proceedings-Optoelectronics 152 (3): 170-173 JUN 2005(0)
89. Y. A. Chang, H. C. Kuo, Y. H. Chang, S. C. Wang "Improved photoluminescence of 1.26 mu m InGaAs/GaAs quantum wells assisted by Sb surfactant and indium-graded intermediate layers" Applied Physics Letters 87 (6): Art. No. 061908 AUG 8 2005(0)
90. C. C. Kao, Y. C. Peng, H. H. Yao, J. Y. Tsai, Y. H. Chang, J. T. Chu, H. W. Huang, T. T. Kao, T. C. Lu, H. C. Kuo, S. C. Wang, Lin CF "Fabrication and performance of blue GaN-based vertical-cavity surface emitting laser employing AlN/GaN and Ta2O5/SiO2 distributed Bragg reflector" Applied Physics Letters 87 (8): Art. No. 081105 AUG 22 2005(0)
91. Y. A. Chang, F. I. Lai, H. C. Yu, H. C. Kuo, L. W. Laih, C. L. Yu, S. C. Wang "High temperature stability 850-nm In0.15Al0.08Ga0.77As/Al0.3Ga0.7As vertical-cavity surface-emitting laser with single Al0.75Ga0.25As current blocking layer" Japans Journal of Applied Physics 44 (28-32): L901-L902 2005(0)
92. F. I. Lai, H. C. Kuo,Y. H. Chang,M. Y. Tsai, C. P. Chu, S. Y. Kuo, S. C. Wang, N. Tansu , Yeh JY, Mawst LJ "Temperature-dependent photoluminescence of highly strained InGaAsN/GaAs quantum wells (lambda=1.28-1.45 mu m) with GaAsP strain-compensated layers" Japans Journal of Applied Physics 44 (8): 6204-6207 AUG 2005(0)
93. Y. J. Lee, T. C. Hsu, H. C. Kuo, S. C. Wang, Y. L. Yang, S. N. Yen, Y. T. Chu,Y. J. Shen, M. H. Hsieh, M. J. Jou, Lee BJ "Improvement in light-output efficiency of near-ultraviolet InGaN-GaN LEDs fabricated on stripe patterned sapphire substrates" Materials Sciences and Engineering B-SOLID State Materials for Advanced Technology 122 (3): 184-187 SEP 25 2005(1)
94. H. W. Huang, J. T. Chu, C. C. Kao, T. H. Hseuh, T. C. Lu, H. C. Kuo, S. C. Wang, Yu CC "Enhanced light output of an InGaN/GaN light emitting diode with a nano-roughened p-GaN surface" Nanotechnology 16 (9): 1844-1848 SEP 2005(0)
95. HPD Yang , Y. H. Chang, F. I. Lai, H. C. Yu,Y. J. Hsu, G. Lin, R. S. Hsiao, H. C. Kuo, S. C. Wang,J. Y. Chi "Singlemode InAs quantum dot photonic crystal VCSELs" Electronics Letters 41 (20): 1130-1132 SEP 29 2005(0)

96. Y. J. Lee, H. C. Kuo, S. C. Wang, T. C. Hsu, M. H. Hsieh, M. J. Jou, B. J. Lee "Increasing the extraction efficiency of AlGaInP LEDs via n-side surface roughening" IEEE Photonics Technology Letters 17 (11): 2289-2291 NOV 2005(0)
97. T. H. Hsueh, J. K. Sheu, H. W. Huang,Y. H. Chang,M. C. Ou-Yang, H. C. Kuo, S. C. Wang "Fabrication and characterization of In0.25Ga0.75N/GaN multiple quantum wells embedded in nanorods" Japanese Journal of Applied Physics 44 (10): 7723-7725 OCT 2005(0)
98. I. L. Chen, W. C. Hsu, H. C. Kuo, H. C. Yu, C. P. Sung, C. M. Lu, C. H. Chiou, J. M. Wang, Y. H. Chang, T. D. Lee, Wang JS " Low-threshold-current-density, long-wavelength, highly strained InGaAs laser grown by metalorganic chemical vapor deposition" Japanese Journal of Applied Physics 44 (10): 7485-7487 OCT 2005(0)
99. P. C. Peng, Y. H. Chang, H. C. Kuo, W. K. Tsai, G. Lin , C. T. Lin, H. C.Yu, H. P.Yang, R. S.Hsiao, K. F.Lin, J. Y.Chi, S.Chi , S. C. Wang "1.3 mu m quantum dot vertical-cavity surface-emitting laser with external light injection" Electronics Letters 41 (22): 1222-1223 OCT 27 2005(0)
100. J. T.Chu, C. C.Kao, H. W.Huang, W. D.Liang,C. F.Chu, T. C.Lu, Kuo HC, S. C. Wang "Effects of different n-electrode patterns on optical characteristics of large-area p-side-down InGaN light-emitting diodes fabricated by laser lift-off" Japanese Journal of Applied Physics, 44 (11): 7910-7912 NOV 2005(0)
101. Y. J.Lee, H. C.Tseng, H. C. Kuo, S. C. Wang, C. W.Chang, T. C.Hsu, Y. L.Yang, M. H.Hsieh, M. J.Jou, B. J.Lee "Improvement in light-output efficiency of AlGaInP LEDs fabricated on stripe patterned epitaxy" IEEE Photonics Technology Letters 17 (12): 2532-2534 DEC 2005(0)
102. Wan Kuang, Jiang-Rong Cao, Tian Yang, Sang-Jun Choi, Po-Tsung Lee, John D. O'Brien, and P. Daniel Dapkus, "Classification of modes in suspended membrane, 19 missing hole photonic crystal micro-cavities," *J. Opt. Soc. Am. B,* 22, pp. 1092-1099 (2005) (SCI IF:2.649)
103. H. C. Kuo, Y. S.Chang, F. Y.Lai, T. H.Hseuh, L. T.Chu, L. H0Laih, S. C. Wang "High speed performance of 850 nm silicon-implanted AlGaAs/GaAs vertical cavity emitting lasers" Solid-State Electronics 48 (3): 483-485 MAR 2004(1)
104. C. F.Lin, H. H.Yao, J. W.Lu,Y. L.Hsieh, H. C. Kuo, S. C. Wang "Characteristics of stable emission GaN-based resonant-cavity light-emitting diodes" Journal of Cryatal Growth 261 (2-3): 359-363 JAN 19 2004(4)
105. H. C. Kuo, Y. S.C hang, C. F.Lin, T. C.Lu, S. C. Wang "MOCVD growth of high-performance InGaAsP/InGaP strain-compensated VCSELs with 850 nm emission wavelength" Journal of Cryatal Growth 261 (2-3): 355-358 JAN 19 2004(0)
106. H. H.Yao, C. F.Lin, H. C. Kuo, S. C. Wang "MOCVD growth of AlN/GaN DBR structures under various ambient conditions" Journal of Cryatal Growth 262 (1-4): 151-156 FEB 15 2004(4)
107. T. C.Lu, J. Y.Tsai, H. C. Kuo, S. C. Wang " Comparisons of InP/InGaAlAs and InAlAs/InGaAlAs distributed Bragg reflectors grown by metalorganic chemical vapor deposition" Materials Science and Engineering B-Solid State Materials for Advanced Technology 107 (1): 66-69 FEB 25 2004(0)
108. C. C.Kao, Huang HW. Tsai JY, Yu CC, Lin CF, H. C. Kuo, S. C. Wang "Study of dry etching for GaN and InGaN-based laser structure using inductively coupled plasma reactive ion etching" aterials Science and Engineering B-Solid State Materials for Advanced Technology 107 (3): 283-288 MAR 25 2004(2)
109. Huang HW, Kao CC, Tsai JY, Yu CC, Chu CF, Lee JY, Kuo SY, Lin CF, Kuo HC, Wang SC "Effect of rapid thermal annealing on beryllium implanted p-type GaN" MATERIALS SCIENCE AND ENGINEERING B-SOLID STATE MATERIALS FOR ADVANCED TECHNOLOGY 107 (3): 237-240 MAR 25 2004(1)
110. Chu CF, Lai FI, Chu JT, Yu CC, Lin CF, Kuo HC, Wang SC "Study of GaN light-emitting diodes fabricated by laser lift-off technique" JOURNAL OF APPLIED PHYSICS 95 (8): 3916-3922 APR 15 2004(2)
111. Laih LH, Kuo HC, Lin GR, Laih LW, Wang SC "As+-implanted AlGaAs oxide-confined VCSEL with enhanced oxidation rate and high performance uniformity" IEEE PHOTONICS TECHNOLOGY LETTERS 16 (6): 1423-1425 JUN 2004(0)
112. Yu HC, Chang SJ, Su YK, Sung CP, Yang HP, Huang CY, Lin YW, Wang JM, La FI, Kuo HC "Improvement of high-speed oxide-confined vertical-cavity surface-emitting lasers" JAPANESE JOURNAL OF APPLIED

PHYSICS43 (4B): 1947-1950 APR 2004(0)

113. Chang YH, Lai FI, Lu CY, Kuo HC, Yu HC, Sung CP, Yang HP, Wang SC "High-speed (> 10 Gbps) 850 nm oxide-confined vertical cavity surface emitting lasers (VCSELs) with a planar process and reduced parasitic capacitance" SEMICONDUCTOR SCIENCE AND TECHNOLOGY 19 (7): L74-L77 JUL 2004(1)
114. Lin GR, Yu KC, Lin CJ, Kuo HC, Ou-Yang MC "Pumping intensity dependent surface charge accumulation and redshifted microphotoluminescence of silicon-implanted quartz" APPLIED PHYSICS LETTERS 85 (6): 1000-1002 AUG 9 2004(2)
115. Huang HW, Kao CC, Chu JT, Kuo HC, Wang SC, Yu CC, Lin CF "Investigation of GaN LED with Be-implanted Mg-doped GaN layer" MATERIALS SCIENCE AND ENGINEERING B-SOLID STATE MATERIALS FOR ADVANCED TECHNOLOGY 113 (1): 19-23 OCT 15 2004(0)
116. Huang HW, Kao CC, Hsueh TH, Yu CC, Lin CF, Chu JT, Kuo HC, Wang SC "Fabrication of GaN-based nanorod light emitting diodes using self-assemble nickel nano-mask and inductively coupled plasma reactive ion etching" MATERIALS SCIENCE AND ENGINEERING B-SOLID STATE MATERIALS FOR ADVANCED TECHNOLOGY 113 (2): 125-129 OCT 25 2004(3)
117. Lai FI, Hsueh TH, Chang YH, Kuo HC, Wang SC, Laih LH, Song CP, Yang HP "10 Gb/s single-mode vertical-cavity surface-emitting laser with large aperture and oxygen implantation" SEMICONDUCTOR SCIENCE AND TECHNOLOGY 19 (8): L86-L89 AUG 2004(0)
118. Lai F., Chang YH, Hsueh TH, Huang HW, Laih LH, Kuo HC, Wang SC, Guung TC "Improvement of kink characteristics performance of GaAsVCSEL with a indium-tin-oxide top transparent overcoating" MATERIALS SCIENCE AND ENGINEERING B-SOLID STATE MATERIALS FOR ADVANCED TECHNOLOGY 113 (3): 203-206 NOV 15 2004(0)
119. T.C.Lu, W.C. Hu, Y.S.Chang, H. C. Kuo, S. C. Wang "Spectrally resolved spontaneous emission patterns of oxide-confined vertical-cavity surface-emitting lasers" Japanese Journal of Applied Physics 96 (11): 5992-5995 DEC 1 2004(0)
120. Y.H. Cang, H. C. Kuo, F.I. Li,Y.A. ang, C.Y.Lu, L.H.Laih, S. C. Wang "Fabrication and characteristics of high-speed oxide-confined VCSELs using InGaAsP-InGaP strain-compensated MQWs" Journal of Technology 22 (12): 2828-2833 DEC 2004(1)
121. H. C. Kuo, H. H.Yao,Y.H.Cang, Y.A.Cang, M.YTai, JHieh, E.Y.Cang, S. C. Wang "MOCVD growth of highly strained InGaAs : Sb-GaAs-GaAsP quantum well vertical cavity surface-emitting lasers with 1.27 mu m emission" Journal of Cryatal Growth 272 (1-4): 538-542 DEC 10 2004(3)

C. Volume Holographic Materials, Technology and Enabling devices

1. Shiuan-Huei Lin, Po-Lin Chen, Yi-Nan Hsiao and Wha-Tzong Whang, "Fabrication and Characterization of poly (methyl methacrylate) photopolymer doped with 9,10-Phenanthrenequinone (PQ) based derivatives for volume holographic data storage", Optics Communications, Vol. 281, pp. 559-566, 2008.
2. V. Marinova, D. Petrova, S. H. Lin and K.Y. Hsu, "Light-induced and holographic properties of Fe+Mn doubly-doped $Bi_4Ge_3O_{12}$ crystals", Optics Communications, Vol. 281, pp. 37-43, 2008.
3. Shiuan-Huei Lin, Yi-Nan Hsiao, Ken Y. Hsu and Wha- Tzong Whang, "Poly (methyl methacrylate-co-hydroxyethyl methacrylate) photopolymer doped with photoinitiator system Eosin Y Spirit Soluble/Triethanolamine for holographic data storage," in press, J. Optical Memory & Neural Networks, 2008.
4. Shiuan Huei Lin, Po-Lin Chen, Jung-Hwa Lin, Yi-Nan Hsiao and Ken Y. Hsu, "Phenanthrenequinone-doped copolymers for volume holographic data storage applications," submitted to Optical Engineering, 2008.
5. D. Petrova, V. Marinova, R. C. Liou, S. H. Lin and K.Y. Hsu, "Characterization of doped $Bi_4Ge_3O_{12}$ single crystals by light-induced, electrical and photoelectrical measurements" J. of optoelectronics and advanced material, Vol. 9, No. 2, p. 282 – 285, February 2007.
6. Jian-Shuen Fang, Qi Hao, David J. Brady, Mohan Shankar, Bob D. Guenther, Nikos P. Pitsianis, and Ken Y. Hsu, "Path-dependent human identification using a pyroelectric infrared sensor and Fresnel lens arrays", Optics Express Vol. 14, 609-624, 2006, selected by OSA's Virtual J. for Biomedical Optics, Vol. 1, Issue2, Feb. 10,

2006.

7. V. Marinova, S. H. Lin, and Ken Y. Hsu "Light-induced properties of ruthenium-doped $Bi_4Ge_3O_{12}$ crystals" J. Appl. Phys. 98, 113527, 2005.

8. Yi-Nan Hsiao, Wha-Tzong Whang and Shiuan Huei Lin, "Effect of ZnMA on optical and holographic characteristics of doped PQ/PMMA photopolymer," Japanese J. of Appl. Phys., 44 (2), 914-919, 2005.

9. Yi-Nan Hsiao, Wha-Tzong Whang and Shiuan Huei Lin, "Analyses on Physical Mechanism of Holographic Recording in Phenanthrenquinone doped Poly(methyl methacrylate) Hybrid Materials," Optical Engineering, Vol. 43, Issue 9, pp. 1993-2002, 2004.

[International Conferences]

A. Coherent and THz Photonics

1. Tze-An Liu and Ci-Ling Pan, Masahiko Tani, Makoto Nakajima and Masanori Hangyo, Kiyomi Sakai, Shin-ichi Nakashima, "Ultrabroadband terahertz field detection by proton-bombarded InP photoconductive antennas," presented at the 14th International Conference on Ultrafast Phenomena 2004, Niigata, Japan, July 25-30, 2004, paper published in Ultrafast Phenomena XIV: Proceedings of the 14th International Conference, Niigata, Japan, July 25-30, 2004 (Springer Series in Chemical Physics, V. 79), Takayoshi Kobayashi, Tadashi Okada, Tetsuro Kobayashi, Keith A. Nelson, Sandro De Silvestri, Editors, Springer-Verlag, Berlin, 2005, pp. 756-758.
2. Ching-Wei Chen and Ci-Ling Pan, Su-Frang Shu, Chao-Kuei Lee, "Population-split Genetic Algorithm for phase retrieval of ultrafast laser pulses," ibid., pp. 103-105.
3. Chao-Yuan Chen, and Ci-Ling Pan, Cho-Fan Hsieh, and Ru-Pin Pan, "Magnetically Controlled 2π Liquid Crystal Terahertz Phase Shifter," ibid., pp.723-725.
4. Ci-Ling Pan, Cho-Fan Hsieh, and Ru-Pin Pan, Masaki Tanaka, Fumiaki Miyamaru, Masahiko Tani, and Masanori Hangyo, "Control of THz transmission through two-dimensional metallic photonic crystals," postdeadline paper, ibid., pp. 699-701.
5. Kuo-Cheng Yu, Chun-Jung Lin, M.-J. Ou-yang, Hao-Chung Kuo, and Gong-Ru Lin, "Correlation between Surface Charge Accumulation and Pumping Intensity Dependent Red-Shifted Micro-Photoluminescence of Si-Implanted Quartz with Buried Si Nanocrystals", The 2004 Materials Research Society Spring Meeting (MRS2004), poster paper. A4.37, San Francisco CA, USA, April 12-16, 2004.
6. Yu-Sheng Liao and Gong-Ru Lin, "5 GHz optically cross-gain modulation induced mode-locking of semiconductor optical amplifier", OSA/IEEE Conference on Laser and Electro-Optics (CLEO2004), Poster Session II, Paper CWA-#982, San Francisco CA USA, May 16-21, 2004.
7. Jing-Yuan Zhang, Chao-Kuei Lee, Jung Y. Huang, and Ci-Ling Pan, "Sub femto-joule sensitive single-shot XFROG measurements based on optical parametric amplification," ibid., paper CTuZ5.
8. Yi-Chao Wang, Alexei K. Zaitsev and Ci-Ling Pan, Jia-Min Shieh, "New low temperature poly-silicon fabrication technique by near infrared femto-second laser annealing," ibid., paper CThD1.
9. Yung-Cheng Chang and Gong-Ru Lin, "Tunable dual wavelength NRZ-to-RZ format transformed data pulse-train generated from a non-dc-biased laser diode by externally pseudo-random-binary-sequence seeding", OSA/IEEE Conference on Laser and Electro-Optics (CLEO2004), Poster Session II, Paper CWA-#964, San Francisco CA USA, May 16-21, 2004.
10. Yung-Cheng Chang, Yu-Huang Lin, Yu-Sheng Liao, and Gong-Ru Lin, "Tunable Dual-Wavelength NRZ-to-RZ Data-Format Transformer at 10 Gbps Using Non-DC-Biased and Synchronously Modulated Laser Diode", Ninth Optoelectronics and Communications Conference/Third International Conference on Optical Internet (OECC/COIN2004), Poster session, paper 13p-106, Yokohama, Japan, July12-16, 2004

11. Yu-Sheng Liao and Gong-Ru Lin, “Detuning the Duty Cycle of Backward Optical Injection for Optimized Mode-Locking in Semiconductor Optical Amplifier Fiber Laser”, Ninth Optoelectronics and Communications Conference/Third International Conference on Optical Internet (OECC/COIN2004), Poster session, paper 13p-100, Yokohama, Japan, July12-16, 2004.
12. Yu-Huang Lin, Yung-Cheng Chang, Yu-Sheng Liao, and Gong-Ru Lin, “Optically triggered on/off keying of 10-Gbit/s single-mode return-to-zero data pulse-train from Fabry-Perot laser diode”, Ninth Optoelectronics and Communications Conference/Third International Conference on Optical Internet (OECC/COIN2004), Poster session, paper 13p-68, Yokohama, Japan, July12-16, 2004.
13. C.-J. Lin, Y.-L. Chueh, L.-J. Chou, C.-W. Chang, E. W. G. Diau, H.-C. Kuo, and G.-R. Lin, “Countinuous-Wave and Time-Resolved Photoluminescence Analysis of Silicon Nanocrystals Formed by Thermal Annealing of Amorphous Silicon Oxides at Different Times”, 2004 International Conference on Solid State Devices and Materials, Poster session, paper P9-12, Tokyo, September 15-17, 2004.
14. Ci-Ling Pan, “NCTU Photonics Programs: an Overview,” invited talk, presented at the 2005 NRC-IME-ITRI Trilateral Photonics Workshop, Ottawa, Canada, Sept. 27-29, 2004.
15. Tze-An Liu, Zu-sho Chow, Jia-Huey Tsao, Teh-Ho Tao, Chao-Yuan Chen, Cho-Fan Hsieh, Ru-Pin Pan, and Ci-Ling Pan, “THz transmission spectroscopic studies of deoxyhemoglobin, ” presented at the Frontiers in Optics 2004, the 88th Annual Meeting of the Optical Society of America and Laser Sciences XX, Rochester, NY, USA, Oct. 10-14, 2004.
16. Chi-Kuang Lin, Yu-Sheng Liao, Hao-Chung Kuo, and Gong-Ru Lin, “Low-leakage In0.53Ga0.47As p-i-n photodetector fabricated on GaAs substrate with linearly graded metamorphic InxGa1-xP buffer”, 2004 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2004), paper. 5624-61, Beijing, China, November 7-11, 2004.
17. Yi-Hsiang Chiu, Yu-Sheng Liao, and Gong-Ru Lin, “The effect of backward injecting wavelength on the mode-locking dynamics of a semiconductor amplifier based fiber laser”, 2004 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2004), paper. 5624-61, Beijing, China, November 7-11, 2004.
18. Ming-Chung Wu, Yung-Cheng Chang, and Gong-Ru Lin, “Comparison on the noise and jitter characteristics of harmonic injection-locked and mode-locked erbium-doped fiber lasers”, 2004 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2004), paper. 5623-97, Beijing, China, November 7-11, 2004.
19. Ci-Ling Pan, Ru-Pin Pan, Chao-Yuan Chen, T. R. Tsai, C. H. Wang, Cho-Fan Hsieh, “Liquid Crystal THz Optics,” invited talk, presented at the Croucher Advanced Study Institute on “Frontiers of Photonics Research: Nanophotonics, Femtosecond Photonics and Biophotonics,” Hong Kong, December 6-10, 2004.
20. I-Hsiang Chiu, Yu-Sheng Liao, Yung-Cheng Chang, and Gong-Ru Lin, “A 3.5-ps Mode-Locked Semiconductor Optical Amplifier Fiber Laser generated by 60-ps Backward Optical Dark Pulse-Train Injection”, Photonics West 2005, Symposia: Lasers and Applications in Science and Engineering, San Jose, California, 22-27 January 2005.
21. Chi-Kuan Lin, Gong-Ru Lin, Chun-Jung Lin, Hao-Chung Kuo and Chia-Yang Chen, “Silicon Defect and Nanocrystal Related White and Red Electroluminescence of Si-rich SiO_2 Based Metal-Oxide-Semiconductor Diode”, Photonics West 2005, Conference on Fiber Lasers II: Technology, Systems, and Applications, Symposia: Lasers and Applications in Science and Engineering, San Jose, California, 22-27 January 2005.
22. Ming-Chung Wu, Yung-Cheng Chang, and Gong-Ru Lin, “Suppression of Supermode and Phase Noises in Mode-Locked Erbium-Doped Fiber Laser with a Semiconductor Optical Amplifier Based High-Pass Filter”, Photonics West 2005, Conference on Fiber Lasers II: Technology, Systems, and Applications, Symposia: Lasers and Applications in Science and Engineering, San Jose, California, 22-27 January 2005.
23. Chia-Yang Chen, Chun-Jung Lin, Hao-Chung Kuo, Gong-Ru Lin, Yu-Lun Chueh, Li-Jen Chou, Chih-Wei Chang and Eric Wei-Guang Diau, “Improved Near-infrared Luminescence of Si-rich SiO_2 with Buried Si Nanocrystals Grown by PECVD at Optimized N_2O Fluence”, Photonics West 2005, Conference on Synthesis and Photonics of Nanoscale Materials III, Symposia: Lasers and Applications in Science and Engineering, San Jose, California,

22-27 January 2005.

24. Ci-Ling Pan, "An Overview of THz Research Activities in Taiwan," invited talk, presented at the Photonics West 2005, San Jose, California, USA, Jan. 22-27, 2005, published as Proc. SPIE Vol. 5727, pp. 74-81, Terahertz and Gigahertz Electronics and Photonics IV; R. Jennifer Hwu, Kurt J. Linden; Eds., Mar 2005.
25. Chao-Kuei Lee, J. Y. Huang, Ci-Ling Pan, and Jing-Yung Zhang, "Novel Method for Generation of Tunable UV/Blue Femtosecond Pulses," presented at the 2005 Advanced Solid-State Photonics Meeting, paper WB24, Vienna, Austria, Feb. 6-9, 2005, proceeding paper to be published in ASSP2005 TOPS vol. 98, Optical Society of America (young scientist traveling support Award).
26. Ming-Chung Wu, Yung-Cheng Chang, and Gong-Ru Lin, "Phase Noise and Supermode Suppression in Harmonic Mode-Locked Erbium-Doped Fiber Laser with a Semiconductor Optical Amplifier Based High-Pass Filter", Optical Fiber Communication Conference and Exhibit (2005 OFC/NFOEC Meeting), Session OFJ - Pulsed Lasers, Paper OFJ6, Anaheim, California, March 6-11, 2005.
27. Chi-Kuan Lin, Hao-Chung Kuo, Gong-Ru Lin, and M. Feng, "A Low-Dark-Current InGaAs Photodetector Made on Metamorphic InGaP Buffered GaAs Substrate", Optical Fiber Communication Conference and Exhibit (2005 OFC/NFOEC Meeting), Session OFM - Detectors and Receivers, Paper OFM4, Anaheim, California, March 6-11, 2005.
28. Chun-Jung Lin, Gong-Ru Lin, Yu-Lun Chueh, and Li-Jen Chou, "CO_2 Laser Annealing Synthesis of Silicon Nanocrystals Buried in Si-rich SiO_2", 2005 MRS spring Meeting, poster paper A19.2, San Francisco, CA USA, March 28-April 1, 2005.
29. Chia-Yang Chen, Chun-Jung Lin, Hao-Chung Kuo, Gong-Ru Lin, Yu-Lun Chueh, Li-Jen Chou, Chih-Wei Chang and Eric Wei-Guang Diau, "Effects of N_2O Fluence on The PECVD-grown Si-rich SiO_x with Buried Si Nanocrystals", 2005 MRS spring Meeting, poster paper A19.11, San Francisco, CA USA, March 28-April 1, 2005.
30. Ci-Ling Pan, "Ultra-broadband THz field detection by Ion-implanted III-V PC Antenna," invited talk, presented at the Photonics West 2005, San Jose, California, USA, Jan. 22-27, 2005, published as: Proc. SPIE Vol. 5725, pp. 53-60, Ultrafast Phenomena in Semiconductors and Nanostructure Materials IX; Kong-Thon Tsen, Jin-Joo Song, Hongxing Jiang; Eds., Apr 2005.
31. Yung-Cheng Chang, Yu-Huang Lin, J. H. Chen, and Gong-Ru Lin, "All-Optical OC-192 NRZ-to-PRZ Data-Format Conversion by Injection-Locking a Synchronously Modulated Fabry-Perot Laser Diode", OSA/IEEE Conference on Laser and Electro-Optics (CLEO2005), Poster Session III, Paper JThE81, Baltimore MA USA, May 22-27, 2005.
32. I-Hsiang Chiu, Ming-Chung Wu, and Gong-Ru Lin, "Generation of 1.8-ps Mode-Locked Semiconductor Optical Amplifier Fiber Laser Pulses by 60-ps Backward Optical Dark Comb Injection", OSA/IEEE Conference on Laser and Electro-Optics (CLEO2005), Poster Session II, Paper JWB50, Baltimore MA USA, May 22-27, 2005.
33. Yu-Ping Lan, Tsung-Sheng Shih, Ci-ling Pan, Yea-Feng Lin and Ru-Pin Pan, "A WDM Channel Selectable Diode Laser with A Mode-hop-free fine-tuning Mechanism," presented at Conference on Lasers and Electro-Optics, CLEO/QELS'05, Baltimore, Maryland, USA, May 22-27, 2005, paper JTUC88.
34. Zun-Hao Chen, Jia-Min Shieh, Bau-Tong Dai, Yi-Chao Wang, Ci-Ling Pan; "Near-Infrared Femtosecond Laser-Processed Thin-Film Transistor," ibid., paper CFG7.
35. Ching-Wei Chen, Yu-Kuei Hsu, J. Y. Huang, C. S. Chang, Ci-Ling Pan, Jing-Yuan Zhang,"Intense picosecond infrared pulses tunable from 2.4 μm to 38 μm for nonlinear optics applications", paper # CFI3-1, IQEC/CLEO-PR 2005, Tokyo, Japan, July 11-15, 2005 (Student Travel Support Award).
36. Yi-Chao Wang, Alexei Zaitsev, and Ci-Ling Pan, Jia-Min Shieh, Zun-Hao Chen, and Bau-Tong Dai "Near-Infrared Femtosecond Laser activation of shallow B and P doped layers,", paper # CTuC3-P12, IQEC/CLEO-PR 2005, Tokyo, Japan, July 11-15, 2005.
37. Yu-Ping Lan, Pei-Lin Chen and Ci-Ling Pan "Wavelength Stabilization of a DFB Diode Laser Using a Fiber Bragg Grating," paper # CWAB3-P26, IQEC/CLEO-PR 2005, Tokyo, Japan, July 11-15, 2005.
38. Yung-Cheng Chang, Ming-Chung Wu, and Gong-Ru Lin, "A Pulse-Compressed and Harmonic Mode-Locked

SOA-EDFA Laser Link with Suppressed Phase and Supermode Noises", International Conference on Quantum Electronics 2005 and the Pacific Rim Conference on Lasers and Electro-Optics 2005 (IQEC/CLEO-PR 2005), Paper oral CThM1-5, Tokyo, Japan, July 11-15 2005.

39.

40. Yu-Ping Lan, Yi-Fan Lai, Ru-Pin Pan, Ci-Ling Pan, "Automatically Controlled Power Equalizer for Liquid Crystal Based Optical Demultiplexer," paper # CTuC3-P25, IQEC/CLEO-PR 2005, Tokyo, Japan, July 11-15, 2005.
41. Gong-Ru Lin, "Retrospect on the Research of Silicon Nanocrystal Embedded Silicon Oxide Materials and Light-Emitting Devices in NCTU/IEO", 3rd Symposium on Nanophotonics Science and Technology, Hwalian, Taiwan, September 13-17, 2005.
42. Chao-Kuei Lee, J. Y. Zhang, J. Y. Huang, and Ci-Ling Pan, "A novel method of ultrabroad band (White-light) femtosecond optical parametric amplification," presented at Joint Conference on Ultrafast Optics V and Applications of High Field and Short wavelength Sources XI, UFO/HFSW 2005, Nara, Japan, Sept. 25-30, 2005.
43. Ru-Pin Pan, Chao-Yuan Chen, Cho-Fan Hsieh, and Ci-Ling Pan, "A Liquid-Crystal-Based Terahertz Tunable Lyot Filter," paper #ThCC3, presented at the 18th annual meeting of IEEE/LEOS, LEOS 2005, Sydney, Australia, October 23-27, 2005.
44. Cheng Lo, Cho-Fan Hsieh, Ru-Pin Pan and Ci-Ling Pan, "Effects of Hole Material on Enhanced Terahertz Transmission through Metallic Hole Arrays," ibid., paper # ThCC4.
45. Cho-Fan Hsieh, Hung-Lung Chen, Chao-Yuan Chen, Ru-Pin Pan, and Ci-Ling Pan, "Voltage Controlled Liquid Crystal Terahertz Quarter Wave Plate," ibid., paper # ThCC5.
46. Yu-Sheng Liao, and Gong-Ru Lin, "Beyond 10-Gbps operation of a metamorphic InGaP buffered In0.53Ga0.47As p-i-n photodetector grown on GaAs substrate", 2005 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2005), oral paper 6020-75, Shanghai China, November 6-10, 2005.
47. Chun-Jung Lin, Hao-Chung Kuo, and Gong-Ru Lin, "Analysis of silicon nanocrystals in silicon-rich SiO2 synthesized by CO2 laser annealing", 2005 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2005), oral paper 6020-72, Shanghai China, November 6-10, 2005.
48. Ci-Lin Pan and Ru-Pin Pan, "Recent progress in liquid crystal THz optics," invited talk, presented at Photonics West 2006, San Jose, California, USA, Jan. 21-26, 2006, invited paper, in Proceedings of SPIE -- Volume 6135 Liquid Crystal Materials, Devices, and Applications XI, Liang-Chy Chien, Editor, pp. 61350D-1 to -13 (Feb. 23, 2006).
49. Hsiang Chiu and Gong-Ru Lin, "10 Gbit/s All-Optical NRZ-to-RZ Data Format Conversion in a Dark-Optical-Comb Injected Semiconductor Optical Amplifier", Optical Fiber Communication Conference and Exhibit (2006 OFC/NFOEC Meeting), Session JThB, Poster paper JThB33, Anaheim, California, March 5-10, 2006.
50. Hsiang Chiu and Gong-Ru Lin, "10GHz Dark-Optical-Comb Injection-Mode-Locked Semiconductor Optical Amplifier Fiber Laser with 400fs and 30nm Tunable Pulses", Optical Fiber Communication Conference and Exhibit (2006 OFC/NFOEC Meeting), Session OWI, Poster paper OWI28, Anaheim, California, March 5-10, 2006.
51. Hsiang Chiu and Gong-Ru Lin, "Optimization on Cross-Gain-Modulating Power and Wavelength for Pulsed Data-Pattern Reshaping in Optical-Clock Controlled Semiconductor Optical Amplifier", Optical Fiber Communication Conference and Exhibit (2006 OFC/NFOEC Meeting), Session JThB, Poster paper JThB19, Anaheim, California, March 5-10, 2006.
52. Gong-Ru Lin, "White-light and near-infrared electroluminescence of furnace or CO2 laser annealed Si-rich SiO2 with structural defects and Si nanocrystals", 2006 SPIE Symposium on Photonics Europe (PE 2006), paper 6195-32, Strasbourg, France, April 3-6, 2006.

53. Huang-Shen Lin, Chih-Chiang Kao, Chun-Jung Lin, Hao-Chung Kuo, Shing-Chung Wang, and Gong-Ru Lin, “Self-assembled Ni nanodot on SiO2 film: a novel reactive ion etching mask for Si nanopillar formation on Si substrate” 2006 SPIE Symposium on Photonics Europe (PE 2006), paper 6195-32, Strasbourg, France, April 3-6, 2006.
54. Chia-Yang Chen, Chun-Jung Lin, and Gong-Ru Lin, “Synthesis of Erbium Doped Si-rich SiOx by Radio-Frequency Magnetron Cosputtering using Si/SiO/Er2O3 Target”, Materials Research Society’s 2006 Spring Meeting, San Francisco, CA, USA, April 17-21, 2006.
55. Chun-Jung Lin, Gong-Ru Lin, Yu-Lun Chueh, and Li-Jen Chou, “Anomalous Absorption of Silicon Nanocrystals in Silicon-rich SiO1.25 Matrix Precipitated by CO2 Laser Annealing”, 2006 Integrated Photonics Research and Applications (IPRA) and Nanophotonics (NANO) Topical Meeting, Oral paper Nanomaterials NThC4, Uncasville, Connecticut USA, April 24-28, 2006.
56. Chun-Jung Lin, Chi-Kuan Lin, Gong-Ru Lin, “Enhanced Electroluminescence of Si-rich SiOx Based MOS Diode by Interfacial Precipitated Si Nano-Pyramids”, 2006 Integrated Photonics Research and Applications (IPRA) and Nanophotonics (NANO) Topical Meeting, Oral paper Nanomaterials NThC5, Uncasville, Connecticut USA, April 24-28, 2006.
57. Ci-Ling Pan, “An Overview of NCTU Photonics Programs and Selected THz Topics,” invited talk, presented at the NSC-UPM Workshop On Optoelectronics, Sala De Juntas, Edificio A, Etsi Telecomunicacion, Universidad Politechnica Madrid, Madrid, Spain, May 22, 2006.
58. Jia-Min Shieh, Yi-Fan Lai, An-Thung Cho, Wei-Xin Ni, Hao-Chung Kuo, Chih-Yao Fang, Jung Y. Huang, C-Ling Pan, “Ultraviolet Light Detection with Silicon Nanocrystals-embedded Mesoporous Silica Sensing Layer,” paper CTuS4, presented at CLEO/QELS 2006, Long Beach, California, May 21-26, 2006.
59. H.-Y. Huang, Jin-Wei Shi, Y.-S. Wu, J.-I. Chyi, J.-K. Sheu, W.-C. Lai, G.-R. Lin, Ci-Ling Pan, “Modulation-Speed Enhancement of a GaN Based Green Light-Emitting-Diode (LED) by Use of n-type Barrier Doping for Plastic Optical Fiber (POF) Communication,” paper JWB74, presented at CLEO/QELS 2006, Long Beach, California, May 21-26, 2006.
60. Jin-Wei Shi, Yu-Tai Li, Ci-Ling Pan, M.-L. Lin, Y.-S. Wu, W.-S. Liu, J.-I. Chyi; “Separated-Transport-Recombination p-i-n Photodiode (STR-PD) with High-Speed and High-Power Performance under Continuous-Wave (CW) Operation,” paper CTuS6, presented at CLEO/QELS 2006, Long Beach, California, May 21-26, 2006.
61. Yu-Sheng Liao, Gong-Ru Lin, Hao-Chung Kuo, Kai-Ming Feng, Milton Feng, “A 10-Gbps In0.53Ga0.47As p-i-n Photodiode Receiver on Metamorphic InGaP Buffered GaAs Substrate”, OSA/IEEE Conference on Laser and Electro-Optics (CLEO2006), Oral Session CThD - Receivers and Detectors, Paper CThD1, Long Beach, California USA, May 21-26, 2006.,
62. Chun-Jung Lin, Chi-Kuan Lin, and Gong-Ru Lin, “Synthesis of Si Nano-Pyramids at SiO_x/Si Interface for Enhancing Electroluminescence of Si-Rich SiOx Based MOS Diode”, OSA/IEEE Conference on Laser and Electro-Optics (CLEO2006), Joint Poster Session I Paper JTuD43, Long Beach, California USA, May 21-26, 2006.
63. Chi-Ming Hung, Kun-Chieh Yu, Yung-Cheng Chang, and Gong-Ru Lin, “All-Optical Decision Gating of 10 Gbit/s RZ Data Stream with a Reshaping-Optical-Clock Controlled Semiconductor Optical Amplifier”, OSA/IEEE Conference on Laser and Electro-Optics (CLEO2006), Joint Poster Session II Paper JWB36, Long Beach, California USA, May 21-26, 2006.
64. Ru-Pin Pan, Cho-Fan Hsieh, Hsin-Ying Wu, Tsung-Ta Tang, and Ci-Ling Pan, “Electrically controlled liquid crystal 2π terahertz phase shifter,” paper OPTIP-42, presented at the 21th International Liquid Crystal Conference, Keystone, Colorado, July 2-7, 2006.
65. Ru-Pin Pan, Chao-Yuan Chen, Cho-Fan Hsieh, and Ci-Ling Pan, “Temperature-dependent complex refractive

indices and birefringence of nematic liquid crystal 5CB in the terahertz frequency range", paper DEVIP-78, ibid..

66. Tsung-Ta Tang, Hsin-Ying Wu, Chia-Jen Lin, and Ru-Pin Pan, "A Simple Method to Determine the Pitch of Chiral Nematic Liquid Crystal", ibid..
67. Hsin-Ying Wu, Tsung-Ta Tang, Chin-Chieh Wang, Ru-Pin Pan, Shao-Ju. Chang, Jenn-Chang Hwang, "Controllable alignment modes of nematic liquid crystal on argon ion beam bombarded polyimide films", ibid..
68. Jung Y. Huang, "2D IR of Submolecular Reorientation Dynamics in Surface Stabilized Ferroelectric Liquid Crystals with nc-ZnO Doping", DYNAP-6, ibid..
69. Gong-Ru Lin, "All-Optical NRZ-to-RZ Data Format Conversion with Optically Injected Laser Diodes or Semiconductor Optical Amplifiers", 2006 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2006), Session APOC01, paper 6353-93, Gwangju Korea, September 3-7, 2006.
70. Gong-Ru Lin, "All-Optical NRZ-to-RZ Data Format Conversion with Optically Injected Laser Diodes or Semiconductor Optical Amplifiers", 2006 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2006), Session APOC01, paper 6353-93, Gwangju Korea, September 3-7, 2006.
71. Yu-Sheng Liao, I-Shiang Chiu, and Gong-Ru Lin, "Femtosecond Harmonically Optical-Injection Mode-Locked Semiconductor Optical Amplifier Based Fiber Lasers", 2006 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2006), Session APOC01, paper 6351-7, Gwangju Korea, September 3-7, 2006.
72. Kun-Chieh Yu, Yu-Sheng Liao, and Gong-Ru Lin, "Self Optical Decision Gating of Degraded RZ Data Stream at 10Gbits/s with a Optical-Clock-Injected Semiconductor Optical Amplifier", 2006 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2006), Session APOC03, paper 6353-42, Gwangju Korea, September 3-7, 2006.
73. Jun-Yuan Chang, Yu-Sheng Liao, Hai-Han Lu, and Gong-Ru Lin, "Wavelength control of L-band erbium-doped fiber laser with tunable-ratio output couplers", 2006 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2006), Session APOC02, paper 6351-71, Gwangju Korea, September 3-7, 2006.
74. Gong-Ru Lin and Chun-Jung Lin, "SiOx/Si Interfacial Si Nano-Pyramids Enhancd Electroluminescence from Si-Rich SiOx MOSLED", the 3rd International Conference on Group IV Photonics, poster paper 22, September 13-15, Ottawa Canada, 2006.
75. Gong-Ru Lin and Chun-Jung Lin, "Enhancement of Fowler-Nordheim Tunneling Based Light Emission from metal-SiOx-Si MOSLED", the 3rd International Conference on Group IV Photonics, oral paper FA3, September 13-15, Ottawa, Canada, 2006
76. Ci-Ling Pan, "Nonlinear optical studies of Si-O polar nanostructures," invited talk, presented at the 13th Laser Physics Workshop, Zhang Jia Jie, China, Oct. 20-25, 2006.
77. Ru-Pin Pan, and Ci-Ling Pan, "Control of enhanced THz transmission through metallic hole arrays using liquid crystals", invited talk, presented at the 13-th laser physics workshop, Changziajie, Sanxi, China, 20-25, October, 2006,.
78. Hung-Wen Chen, Ja-Yu Lu, Jeng-Liang Kuo, Yu-Tai Li, Ci-Ling Pan, Li-Jin Chen, Po-Jui Chiang, Hung-Chun Chang and Chi-Kuang Sun, "Terahertz Fiber-Based Coupler, " Paper P-3, presented at AP-THz 2006 (1st Asian-Pacific THz Photonics Workshop), Dec. 14, 2006, Hsinchu, Taiwan.
79. Ja-Yu Lu, Yu-Tai Li, Ci-Ling Pan, Chin-Ping Yu, Hung-Chung Chang, Hung-Wen Chen and Chi-Kuang Sun, "Air-Core Microstructure Fiber For Terahertz Radiation Waveguiding," Paper P-4, ibid..
80. Hung-Wen Chen, Ja-Yu Lu, Jeng-Liang Kuo, Yu-Tai Li, Ci-Ling Pan, Li-Jin Chen, and Chi-Kuang Sun, "Study On Attenuation Spectrum Of Subwavelength-Diameter Thz Fibers," Paper P-5, ibid..
81. Yu-Chien Lai, Cho-Fan Hsieh, Ru-Pin Pan, and Ci-Ling Pan, "Polarizing Terahertz Wave with Liquid Crystal," Paper P-6, ibid..
82. Wei-Wen Wang, Yu-Tai Li, Ci-Ling Pan, "THz Radiation Characteristics of the Photonic- Transmitters Based on

Separated- Transport- Recombination Photodiode and Micromachined Slot Antenna," Paper P-7, ibid..

83. Ru-Pin Pan, Chao-Yuan Chen, Cho-Fan Hsieh, Genel Farcy, I-Chen Ho, and Ci-Ling Pan, "The Temperature-Dependent Refractive Indices of Two Typical Liquid Crystals 5CB and PCH5 in the THz Frequency Range," Paper P-8, ibid..
84. Cho-Fan Hsieh, Hsin-Ying Wu, Ru-Pin Pan, Tsung-Ta Tang and Ci-Ling Pan, "Tunable 2π Terahertz Phase Shifter Using a Sandwiched Nematic Liquid Crystal Cell," Paper P-9, ibid..
85. Chia-Jen Lin, Yu-Tai Li , Cho-Fan Hsien, Ru-Pin Pan and Ci-Ling Pan, "Magnetically Controlled Liquid Crystal Terahertz Tunable Phase Grating," Paper P-10, ibid..
86. C. K. Kou, Chao-kuei Lee, Chih-Yu Wang, Tze-An Liu, Jin-Long Peng, Ci-Ling Pan, "Frequency locking of two laser diodes to femtosecond frequency comb –Frequency Standard of THz," Paper P-14, ibid..
87. I-Chen Ho, Cho-Fan Hsieh, Chao-Yuan Chen, Ru-Pin Pan, Ci-Ling Pan, "Electrically Controlled Liquid-Crystal-Based Terahertz Tunable Solc Filter," Paper P-15, ibid. .
88. Yun-Pu Ku, Yi-Chao Wang, Hyeyoung Ahn, Ci-Ling Pan, "THz spectroscopic studies of epitaxial GaN film," Paper P-16, ibid. .
89. Che-Jui Hsu, Jin-Wei Chen, Ci-Ling Pan, "Dielectric Responses in GaSe studied by THz-TDS," Paper P-17, ibid..
90. Ru-Pin Pan and Ci-Ling Pan, "Liquid-Crystal-based Electrically Tunable THz Optical devices," invited talk, presented at Photonics West 2007, San Jose, California, USA, Jan. 20-35, 2007, invited paper published in Proceedings of SPIE -- Volume 6487 Emerging Liquid Crystal Technologies II, Liang-Chy Chien, Editors, item 648709 (Feb. 9, 2007).
91. J.-Y. Lu, C.-P. Yu, H.-C. Chang, H.-W. Chen, Y.-T. Li, C.-L. Pan, and C.-K. Sun, "Air-core microstructure fiber for terahertz radiation waveguiding," presented at Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference/Conference on Photonic Applications, Systems, and Technologies (CLEO/QELS'2007), Baltimore, MD, USA (2007), paper CThLL5.
92. H.-W. Chen, J.-Y. Lu, L. –J. Chen, P. –J. Chiang, H.-C. Chang, , Y.-T. Li, C.-L. Pan, and C.-K. Sun, "THz Fiber Directional Coupler," ibid., paper CThLL7.
93. J.-W. Shi, Yu-Tai Li and Ci-Ling Pan, C.-H. Chiu, M.-L. Lin, W.- S. Liu, and J.-I. Chyi, "Sub-THz Photonic-Transmitters Based on Separated-Transport-Recombination Photodiode and Micromachined Slots Antenna," ibid., paper CMY1.
94. Hung-Wen Chen, Ja-Yu Lu, Li-Jin Chen, Yu-Tai Li, Ci-Ling Pan, Chi-Kuang Sun, "Spectral Loss Characteristics of Subwavelength THz Fibers," ibid., paper JWA107.
95. Ci-Ling Pan, "THz Photonic Elements with Liquid-Crystal-Enabled Functionalities," invited paper, presented at the SURA THz Applications Workshop, Washington, D. C., June 6 – 8, 2007.
96. Kejian Chen, Yutai Li, WingYiu Cheung, Wei-wen Wang, Ci-Ling Pan, and Kam Tai Chan, "CW Sub-Terahertz wave generation by GaAs:O Materials," paper FH1-5, presented at CLEO/Pacific Rim 2007, Seoul, Korea, August 26 - August 31, 2007
97. Tsung-Ta Tang, Ru-Pin Chao, Yi-Chao Wang, Ci-Ling Pan, "THz time-domain spectroscopic studies of a ferroelectric liquid crystal in the SmA* and SmC* phases," Paper O-29, presented at The 11th international conference on ferroelectric liquid crystals, Sapporo, Japan, Sep. 3 – 8, 2007.
98. Ci-Ling Pan, "Overview of NCTU Photonics Programs and Selected Topics in Laser Technology and Optics of Structured Materials," invited talk, presented at the 2nd Cross-Strait Workshop on Optical Microstructures and Laser Technology, Nanjing, China, Sept. 11 – 16, 2007.
99. Jung Y. Huang, Liu S. Li, and Ming C. Chen, "Molecular Binding Effect from a Doping of ZnO Nanocrystals in Surface Stabilized Ferroelectric Liquid Crystal", Oral paper presented in the 11th International Conference on Ferroelectric Liquid Crystal, Hokkaido University, Sapporo, Japan, September 3-8, 2007.
100. Cho-Fan Hsieh, Yu-Chien Lai, Ru-Pin Pan, Ci-Ling Pan, "A Liquid-Crystal-Based Terahertz Polarizer," presented at Frontiers in Optics 2007/Laser Science XXIII conferences, San Jose, California, USA, September 16-20, 2007, in Laser Science, OSA Technical Digest (CD) (Optical Society of America, 2007), paper JSuA2.

101. Chia-Jen Lin, Yu-Tai Li, Cho-Fan Hsieh, Ru-Pin Pan, Ci-Ling Pan, “Terahertz Beam Splitting by Tunable Liquid Crystal Phase Grating,” ibid., in Laser Science, OSA Technical Digest (CD) (Optical Society of America, 2007), paper JSuA4.
102. Ci-Ling Pan, Hyeyoung Ahn, Chun-Hao Chuang and Yi-Chao Wang, “Optical-Pump-THz-Probe studies of femtosecond-laser annealed amorphous silicon,” invited talk, presented in Terahertz Photonics, Conference PA120, SPIE Photonics Asia Conferences, also the 2nd Asian-Pacific Workshop on THz Photonics (AP-THz2007), 11 - 15 November 2007, Beijing International Convention Centre, Beijing China.
103. Ci-Ling Pan, Ru-Pin Pan, I-Chen Ho, Cho-Fan Hsieh and Chao-Yuan Chen, “Birefrient Terahertz filters using nematic liquid crystals,” invited talk, presented at Photonics West 2008, San Jose, California, USA.
104. Yu-Tai Li, Ci-Ling Pan, J.-w. Shi, Cheng-Yu Huang, Nan-Wei Chen, Shu-Han Chen, J.-i. Chyi, “Sub-THz Photonic-Transmitters Based on GaAs/AlGaAs Uni-Traveling Carrier Photodiode and Micromachined Circular Disk Monopole Antenna for Ultra-Wideband Communication,” to be presented at Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference/Conference on Photonic Applications, Systems, and Technologies (CLEO/QELS’2007), May 4-9, 2008, San Jose, California, USA, paper CThD5.
105. Chao-Kuei Lee, Sung-Hui Lin, Ci-Ling Pan, “Enhancement of Broadband Terahertz Radiation by Carrier Dynamics Modulation with a Single Chirped Optical Pulse,” ibid., paper JWA37.
106. C. W. Chow, C. H. Yeh, Y. T. Li, C. H. Wang, F. Y. Shih, Y. M. Lin, C. L. Pan, S. Chi, “Demonstration of High Spectral Efficient Long Reach Passive Optical Networks Using OFDM-QAM,” ibid., paper CPDB7, postdeadline session II.
107. Chia-Jen Lin, Chuan-Hsien Lin, Yu-Tai Li, Cho-Fan Hsieh, Ru-Pin Pan, and Ci-Ling Pan, “Electrically Controlled Liquid Crystal Terahertz Phase Grating,” to be presented at the 22nd International Liquid Crystal Conference, June 29-July 3, 2008, ICC Jeju, Jeju Island, Korea, paper APP32.
108. Ru-Pin Pan, Cho-Fan Hsieh, Ci-Ling Pan, Viacheslav. V. Meriakri, Mikhail. P. Parkhomenko, Evgenii.E.Chigrai, “Dielectric properties of liquid crystals in the millimeter and sub-millimeter or THz frequency range,” Paper ID: hal-00265930, to be presented at 5th International Conference on Broadband Dielectric Spectroscopy And Its Applications, 26 to 29 August , 2008, Lyon, France.
109. V. V. Meriakri, Ci-Ling Pan, Ru-Pin Pan, M. P. Parkhomenko, E. E.Chigrai, “Measurement of dielectric properties of liquid crystals in the THz range,” to be presented at 4th International Conference On Advanced Optoelectronics And Lasers (CAOL’2008) September 29 – October 4, 2008, Alushta, Crimea, Ukraine.

B. Quantum (Photonic Crystal) structures and Enabling devices

1. C. Chiu, H. Kuo, C. Lee, C. Lin, H. Huang, T. Lu, S. Wang and K. Leung, "Study of the Thin-Film GaN-Based LEDs with TiO2/SiO2 Omnidirectional Reflectors and PEC Roughened Surfaces," 212th Meeting of the Electrochemical Society in Washington, DC from October 7 - 12, 2007.
2. Y. Lee, C. Chiu, H. Kuo, T. Lu, S. Wang, K. Nar, K. Lau, Z. Yang, S. Chang and S. Lin, "Simultaneously Enhancing Internal and Extraction Efficiencies of GaN-based Light Emitting Diodes Via Chemical-Wet-Etching Patterned-Sapphire-Substrate (CWE-PSS)," 212th Meeting of the Electrochemical Society in Washington, DC from October 7 - 12, 2007.
3. C.E. Lee, C.H. Chiu, M.H. Lo, H.W. Huang, T.C. Lu, H.C. Kuo, S.C. Wang, “MOCVD Growth of GaN-Based LEDs With Naturally Formed Nano-pyramids”, 2007 International Conference on Solid State Devices and Mayterials (SSDM), Tsukuba International Congress Center, Ibaraki, Japan**, S**ept 18-21, 2007 (oral presentation)
4. C. F. Lai, H. C. Kuo, T. C. Lu, S. C. Wang, H. T. Hsueh, J.-F. T. Wang, C. H. Chao, W. Y. Yeh and J. Y. Chi, “Azimuthal Anisotropy of Light Extraction from Photonic Crystal Light-emitting Diodes”, 7th International Conference on Nitride Semiconductors, MGM Grand Hotel, Las Vegas, Nevada, USA, Sept. 16-21 2007
5. Te-Chung Wang, Tsung-Shine Ko, Run-Ci Gao, Tien-Chang Lu, Hao-Chung Kuo, Sing-Chung Wang, Jenq-Dar Tsay, ”The Internal Quantum Efficiency Behavior of a-Plane and c-Plane InGaN/GaN MQWs with Different

Indium Compositions”, WP112, The 7th International Conference on Nitride Semiconductors, MGM Grand Hotel, Las Vegas, Nevada, USA, Sept. 16-21 2007

6. Tien-chang Lu, C. C. Kao, G. S. Huang, H. C. Kuo, and S. C. Wang “Recent progress on GaN-based vertical cavity surface emitting lasers,” *Invited talk*, 6766-15, SPIE Optics East, Seaport World Trade Center, Boston, Massachusetts USA, Sept. 9-12, 2007
7. Tien-chang Lu, C. C. Kao, G. S. Huang, H. C. Kuo, and S. C. Wang “Optically and Electrically Pumped GaN-based VCSELs,” *Invited talk*, WA2-1, The 7th Pacific Rim Conference on Lasers and Electro-Optics (CLEO/PR 2007), COEX, Seoul, Korea Aug. 26-31, 2007
8. S. C. Lin, T. C. Wang, T. S. Ko, T. C. Lu, H. C. Kuo and S. C. Wang, “Characteristics of ultraviolet nonpolar InGaN/GaN light emitting diodes using trench epitaxial lateral overgrowth technology,” WP-043, The 7th Pacific Rim Conference on Lasers and Electro-Optics (CLEO/PR 2007), COEX, Seoul, Korea Aug. 26-31, 2007
9. J. R. Chen, Y. A. Chang, H. C. Kuo, T. C. Lu, Y. K. Kuo, and S. C. Wang, “Theoretical and Experimental Analysis of Temperature-Insensitive 655-nm Resonant-Cavity LEDs,” WA1-4, The 7th Pacific Rim Conference on Lasers and Electro-Optics (CLEO/PR 2007), COEX, Seoul, Korea Aug. 26-31, 2007
10. T. S. Ko, T. C. Wang, J. R. Chen, M. H. Lo, G. S. Huang, T. C. Lu, H. C. Kuo, S. C. Wang, “The effects of H_2/NH_3 gas flow during growth process on the morphology and hole concentration of a-plane p-type GaN”, 15th International Conference on Crystal Growth, Salt Lake City, Utah, USA, Aug. 12-17, 2007
11. T. S. Ko, T. C. Wang, J. R. Chen, M. H. Lo, C. P. Chu, G. S. Huang, T. C. Lu, H. C. Kuo, S. C. Wang, “Defects reduction and luminescence improvement of a-plane GaN structure by inserting SiNx nanomask “, 15th International Conference on Crystal Growth, Salt Lake City, Utah, USA, Aug. 12-17, 2007
12. Tsung-Shine Ko, Chia-Pu Chu, Tien-Chang Lu, Hao-Chung Kuo, and Shing-Chung Wang, “Characteristics of indium oxide nanoloquats grown by thermal evaporation”, 15th International Conference on Crystal Growth, Salt Lake City, Utah, USA, Aug. 12-17, 2007
13. Hou-guan Chen, Tsung-shine Ko, Li Chang, Yue-han Wu, Tien-chang Lu, Hao-chung Kuo, and Shing-chung Wang, “Investigation on microstructure in GaN epitaxial growth on the striped patterened r-plane sapphire substrates”, 15th International Conference on Crystal Growth, Salt Lake City, Utah, USA, Aug. 12-17, 2007
14. T. S. Ko, T. C. Wang, J. R. Chen, M. H. Lo, C. P. Chu, G. S. Huang, T. C. Lu, H. C. Kuo, S. C. Wang, “Defects reduction and luminescence improvement of a-plane GaN by inserting SiN_x nanomasks”, International Conference on Materials for Advanced Technologies 2007, Singapore, July 1~6, 2007
15. T. S. Ko, T. C. Wang, J. R. Chen, M. H. Lo, C. P. Chu, G. S. Huang, T. C. Lu, H. C. Kuo, S. C. Wang, “The effects of H_2/NH_3 gas flow during growth process on the morphology and hole concentration of *a*-plane p-type GaN”, International Conference on Materials for Advanced Technologies 2007, Singapore, July 1~6, 2007
16. G. S. Huang, M. H. Lo, J.-R. Chen, Chen Hou-Guang, J. R. Chu, T. S. Ko, T. C. Lu, H. C. Kuand S. C. Wang, “Room Temperature Ultraviolet Emission from In-Rich Ingan/AlGaN Multiple Quantum Wells”, International Conference on Materials for Advanced Technologies 2007, Singapore, July 1~6, 2007
17. M. H. Lo, G. S. Huang, T. S. Ko, J. R. Chen, H. C. Kuo, T. C. Lu and S. C. Wang, “Improvement in extraction efficiency of ultraviolet light emitting diodes with natural textured surface of p-GaN at various growth temperatures”, International Conference on Materials for Advanced Technologies 2007, Singapore, July 1~6, 2007
18. J. R. Chen, G. S. Huang, Ming-Hua Lo, Tsung-Shine Ko, T. C. Lu, H. C. Kuo and S. C. Wang, “Improvement in extraction efficiency of ultraviolet light emitting diodes with natural textured surface of p-GaN at various growth temperatures”, International Conference on Materials for Advanced Technologies 2007, Singapore, July 1~6, 2007
19. T S Ko, C P Chu, T C Lu, H C Kuo, and S C Wang, “Characteristics of indium oxide nano-loquats grown by thermal evaporation, ” European Material Research Society 2007 Spring Meeting, Strasbourg France, May 28 - June 1, 2007
20. H L Chang, T S Ko, T C Lu, H C Kuo, and S C Wang, “Effect of oxygen on characteristics of nickel oxide / indium tin oxide heterojunction diodes,” E-MRS, European Material Research Society 2007 Spring Meeting,

Strasbourg France, May 28 - June 1, 2007

21. C. F. Lai, P-C. Yu, T. C. Wang, H. C. Kuo, T. C. Lu, S. C. Wang, and C. K. Lee “Ultraviolet lasing characteristics of a GaN photonic crystal defect emitter”, Conference on Lasers and Electro-Optics (CLEO 2007), CThB3, Baltimore, MD, USA, May 6-11, 2007
22. J. T. Chu, T. C. Lu, H. C. Kuo, and S. C. Wang, “Emission characteristics of InGaN/GaN vertical-cavity surface-emitting lasers”, Conference on Lasers and Electro-Optics (CLEO 2007), JWA124, Baltimore, MD, USA, May 6-11, 2007
23. Y. J. Lee, H. C. Kuo, T. C. Lu, and S. C. Wang, “High light-extraction GaN-based vertical LEDs with double diffuse surfaces”, Conference on Lasers and Electro-Optics (CLEO 2007), CTuI4, Baltimore, MD, USA, May 6-11, 2007
24. F. I. Lai, H. W. Huang, C. H. Chiu, C. F. Lai, T. C. Lu, H. C. Kuo, and S. C. Wang, “INGaN/GaN MQW nanorods LED fabrication by ICP-RIE and PEC oxidation processes”, Conference on Lasers and Electro-Optics(CLEO 2007), CMO3, Baltimore, MD, USA, May 6-11, 2007
25. C. C. Kao, T. C. Lu, T. T. Kao, L. F. Lin, H. C. Kuo, and S. C. Wang, “The characteristics of a high-Q GaN micro-cavity light emitting diode”, Conference on Lasers and Electro-Optics (CLEO 2007), CMF4, Baltimore, MD, USA, May 6-11, 2007.
26. Tsan-Wen Lu, Chung-Chuan Tseng, Chia-Min Yu, and Po-Tsung Lee, “Photonic Crystal Circular-Shaped Microcavity Laser with High Quality Factor Whispering-Gallery Mode and Uniform Coupling Property,” F2A-4, *IEEE WFOPC’07*, Taipei, Taiwan (2007)
27. Tsan-Wen Lu, Jyun-Hao Fan, Feng-Mao Tsai, and Po-Tsung Lee, “High quality factor circular photonic crystal microcavity lasers,” TuF4-5, *CLEO-PR’07*, Soeul, Korea (2007)
28. Po-Tsung Lee, Tzu-Yueh Chang, and Ssu-Yuan Chen, “Investigation of Electrical Pulse Erasing Method Effect on Current-Voltage Characteristics of Organic Bistable Device,” Thu-P6-04, *IDMC’07*, Taipei, Taiwan (2007)
29. Tzu-Yueh Chang, Ssu-Yuan Chen, and Po-Tsung Lee, “Investigation of Deposition Rate Effect on the Current-Voltage Characteristics of Organic Dynamic Random Access Bistable Devices,” p.19, *SID’07*, Long Beach, CA, USA (2007) (SID’07 Student Travel Grant Award)
30. Ssu-Yuan Chen, Tzu-Yueh Chang, and Po-Tsung Lee, “Bistable Characteristics of the Organic Device with Heterojunction,” O3.11, *MRS’07 Spring Meeting*, San Francisco, CA, USA (2007)
31. H. H. Yao, G. S. Huang, T.C. Lu, H. C. Kuo and S. C. Wang, “Effects of growth interruption time on InGaN/GaN quantum dots size grown by metal organic chemical vapor deposition”, in Gallium Nitride materials and devices, Vol 6121, part of SPIE’s Integrated Optoelectronics Devices, 2006 San Jose, CA, USA. (2006).
32. H. H. Yao, Y. T. Wang, T. C. Lu, H. C. Kuo, S. C. Wang and L. H. Peng, ”Infrared Reflectance of Optic Phonon Modes in AlGaN Epitaxial Layers Grown on Sapphire Substrates ” 2006 MRS SPRING MEETING, 17-21 April, San Francisco, CA, USA(2006)
33. T. S. Ko, C. F. Lay, Y. J. Lee, T. C. Lu, H. C. Kuo, S. C. Wang, ”Characteristics of InGaN multiple quantum wells on patterned sapphire substrates”13th International Conference on Metal Organic Vapor Phase Epitaxy, 22-26 May, Miyazaki, Japan.(2006)
34. G. S. Huang, H. H. Yao, T. C. Lu, H. C. Kuo, S. C. Wang, ”Fabrication and characterization of active region of a terahertz GaN/AlGaN quantum cascade laser” 13th International Conference on Metal Organic Vapor Phase Epitaxy, 22-26 May, Miyazaki, Japan.(2006)
35. H. H. Yao, H. G. Chen, G. S. Huang, T. C. Lu, H. C. Kuo, S. C. Wang, ”High Quality and Crack-Free AlN/GaN Distributed Bragg Reflector Grown by Metal Organic Chemical Vapor Deposition” 13th International Conference on Metal Organic Vapor Phase Epitaxy, 22-26 May, Miyazaki, Japan.(2006)
36. Y. A. Chang, C. C. Kuo, T. T. Kao, W. K. Tsai, C. L. Yu, Y. T. Wu, F. I. Lai, L. W. Laih, L. H. Laih, H. C. Kuo, T. C. Lu, and S. C. Wang, ”MOCVD growth and characterization of temperature insensitive 650-nm

resonant-cavity light-emitting diodes" 13th International Conference on Metal Organic Vapor Phase Epitaxy, 22-26 May, Miyazaki, Japan.(2006)

37. Y. A. Chang, C. C. Kuo, J. T. Chu, J. R. Chen, S. H. Yen, C. L. Yu, I. T. Wu, F. I. Lai, T. C. Lu, Y. K. Kuo, and S. C. Wang, "Growth and fabrication of p-side-down InGaAs:Sb/GaAs vertical-cavity surface-emitting lasers" 13th International Conference on Metal Organic Vapor Phase Epitaxy, 22-26 May, Miyazaki, Japan (2006)
38. Y. A. Chang, S. H. Yen, T. H. Ko, T. C. Wang, C. Y. Lu, H. C. Kuo, Y. K Kuo, T. C Lu, S. C. Wang," Experimental and Theoretical Analysis on Ultraviolet 370-nm AlGaInN Light-Emitting Diodes" CLEO/QELS 2006, 20-26 May, USA(2006)
39. Y. J. Lee, T.C. Lu, H.C. Kuo, S. C. Wang, J. M. Hwang, T. C. Hsu, M. H. Hsieh, and M. J. Jou," Fabricating GaN-based LEDs with V-Shape Sapphire Facet Mirror by Double Transferred Scheme " CLEO/QELS 2006, 20-26 May, USA(2006)
40. Y. J. Lee, T.C. Lu, H.C. Kuo, S. C. Wang, T. C. Hsu, M. H. Hsieh, M. J. Jou, and B. J. Lee," High Brightness AlGaInP-based LEDs with the Stripe Patterned Omni-Directional Reflector" CLEO/QELS 2006, 20-26 May, USA(2006)
41. Y. C. Lee, C. E. Lee, B. S. Cheng, T. C. Lu, H. C. Kuo, S. C. Wang and S. W. Chiou," High Performances of 650 nm Resonant Cavity Light Emitting Diodes for Plastic Optical Fiber Application" SSDM 2006, 12-15 September, Yokohama, Japan.(2006)
42. H. G. Chen[1], N. F. Hsu, J. T. Chu, H. H. Yao, T. C. Lu, H. C. Kuo and S. C. Wang," Strong Ultraviolet Emission from InGaN/AlGaN Multiple Quantum Well Grown by Multi-step Process" SSDM 2006, 12-15 September, Yokohama, Japan.(2006)
43. C. F. Lai, H. C. Kuo, T. S. Ko, C. E. Lin, C. H. Lin, K. M. Leung, T. C. Lu and S. C. Wang," High Power and High Reliability InGaN/GaN ITO Flip Light Emitting Diodes with TiO_2/SiO_2 Multilater Stack Omnidirectional Reflector "IWN 2006, 22-27 October, Kyoto, Japan.(2006)
44. G. S. Huang, H. G. Chen, T. C. Lu, T. T. Kao, H. H. Yao, H. C. Kuo, S. C. Wang," Crack-free epitaxial nitride microcavity using highly reflective AlN/GaN and Ta_2O_5/SiO_2 Bragg mirrors" IWN 2006, 22-27 October, Kyoto, Japan.(2006)
45. T. S. Ko, T. C. Wang, R. C. Gao, C. P. Chu, T. C. Lu, H. C. Kuo, S. C. Wang, "Study on growth condition of(11-20) a-plane GaN on (1-102) r-plane sapphire by MOCVD" IWN 2006, 22-27 October, Kyoto, Japan.(2006)
46. C. F. Lin, Z. J. Yang, B. C. Shieh, C. C. Chang, H. C. Kuo, S. C. Wang, R. J. Tsai, and C. C. Yu, "InGaN-based Light Emitting Diodes with Inclined Undercut Structure" IWN 2006, Kyoto, Japan.(2006)
47. Y. J. Lee, T. C. Lu, H. C. Kuo, S. C. Wang, T. C. Hsu, and M. H. Hsieh, "Fabrication and characterization of GaN-based LEDs grown on chemical wet-etched patterned sapphire substrates(CWE-PSS)" IWN 2006, 22-27 October ,Kyoto, Japan.(2006)
48. H. C. Kuo, T. C. Lu, Y.J. Lee, H. G. Huang, and S. C. Wang, "Improvement in the Extraction Efficiency of AlGaInP and GaN Thin Film LEDs Via n-Side Surface Roughing"210th ECS MEETING, 29 October- 3 November, Cancun, Mexico.(2006)
49. T.S. Ko, S. Yang, H.C. Hsu, C.P. Chu, H.F. Lin, S.C. Liao, T.C. Lu, H.C. Kuo, W.F. Hsieh, S.C. Wang," ZnO nanopowders fabricated by dc thermal plasma synthesis "AVS 53rd International Symposium & Exhibition, 12-17 November, San Francisco, CA, USA(2006)
50. T. C. Lu, C. C. Kao, H. W. Huang, J. T. Chu, G. S. Huang, H. C. Kuo and S. C. Wang, "Light enhancement in GaN-based emitters by nano-fabrication technique", 5th Cross-strait workshop on Nanoscience and Nanotechnology, 9~11 December, 2006, Hong Kong(2006)
51. Po-Tsung Lee, Tsan-Wen Lu, Feng-Mao Tsai, and Tien-Chang Lu, "Lasing Action of Octagonal Quasi-Periodic Photonic Crystal Micro-Cavities," ThB1.3, *IEEE/LEOS IPRM'06*, Princeton, NJ, USA (2006)
52. Tsan-Wen Lu, Feng-Mao Tsai, Po-Tsung Lee, and Tien-Chang Lu, "Modified Octagonal Quasi-Periodic Photonic Crystal Single-Defect Micro-Cavity Lasers," JWB11, *CLEO/QELS'06*, Long Beach, CA, USA (2006)
53. Feng-Mao Tsai, Po-Tsung Lee, Tsan-Wen Lu, and Tien-Chang Lu, "Fabrication and Characteristics of

Two-Dimensional Quasi-Periodic Photonic Crystal Lasers," CMKK6, *CLEO/QELS'06*, Long Beach, CA, USA (2006)

54. Y. H. Chang, G. R. Lin, H. C. Kuo, Jim Y. Chi, and S. C. Wang," Singlemode Monolithically Quantum-Dot Vertical-Cavity Surface-Emitting Laser in 1.3 μm with Side-mode Suppression ratio > 30dB," IEEE/LEOS, Conference, paper 401,. 2005
55. H. P. D. Yang, F. I. Lai, Y. H. Chang, H. C. Yu, C. P. Sung, H. C. Kuo, S. C. Wang, S. Y. Lin,J. Y. Chi," Single Mode (SMSR > 40 dB) Proton-Implanted Photonic Crystal Vertical-Cavity Surface-Emitting Lasers," IEEE/LEOS, Conference, paper 466,. 2005
56. H. H. Yao, G.S. Huang, Y. T. Wang、W. D. Liang、C. Y. Chen、M. You、H. C. Kuo and S. C. Wang," Growth of III-nitrides nano-structures by metal-organic chemical vapor deposition" EW-MOVPE Conference,2005
57. T. H. Hsuech, M. Y. Tsai, T. C. Wang, H. C. Kuo, and S. C. Wang, "Effects of Thermal Annealing on Optical Properties of InGaN Quantum Dots Grown by Metalorganic Chemical Vapor Deposition ," CLEO 2005, JTuH2-3 2005 Japan
58. H H Yao, G. S Huang, C Y Chen, W D Liang, H. C. Kuo, and S. C. Wang, "Study of InGaN Self-assembled Quantum Dots with Interruption Growth by Metal Organic Chemical Vapor Deposition," CLEO 2005, JTuH2-4 2005 Japan
59. F I Lai, W Y Chen, C C Kao, C F Lin, H. C. Kuo, and S. C. Wang, "Enhancement of Light-output of GaN-based Light-emitting Diodes by Bias-assisted Photoelectrochemical Oxidation of p-GaN in H_2O ," CLEO 2005, CTuN3-2 2005 Japan
60. J. T. Chu, W. D. Liang, C. C. Kao, H W Huang, T. C. Lu, H. C. Kuo, and S. C. Wang "Optically Pumped GaN-based Vertical Cavity Surface Emitting Laser at Room Temperature," CLEO 2005, CTuJ3-5 2005 Japan
61. C. C. Kao, H. H. Yao, Y. C. Peng T. C. Lu, H. C. Kuo, and S. C. Wang, "An Optically Pumped Blue GaN-based Vertical-cavity Surface Emitting Laser Employing A1N/GaN and Ta_2o_5 / Sio_2 Distributed Bragg Reflectors," CLEO 2005, CTuJ3-6 2005 Japan
62. Y. J. Lee, T. C. Hsu, Y. L. Yang S. N. Yen, Y T Chu, Y J Shen, M H Hsieh, M J Jou, B J Lee, H. C. Kuo, and S. C. Wang, "Improvement in Light-output Efficiency of Near-Ultraviolet InGaN-GaN LEDs Fabricated on Stripe Patterned Sapphire Substrate ," CLEO 2005, CWAB3-P53 2005 Japan
63. F. Lai, Y. Chang, H. Yang, H. .Yu, H. C. Kuo, and S. C. Wang "Single Mode Output(SMSR＞40dB)Utilizing Photonic Crystal on Proton-Implanted Vertical-Cavity Surface-Emitting Lasers," CLEO 2005, CThE2-1 2005 Japan
64. Min-Ying Tsai, Tao-Hung, Ya-hsien Chang, H. C. Kuo and S. C. Wang, "Optical Properties of Ultra-High-Density InGaN Quantum Dots Grown by Metalorganic Chemical Vapor Deposition "，Second Asia-Pacific Workshop on Widegap Semiconductors (APWS-2005),March 7-9, 2005, Hsinchu Lakeshore Hotel, Hsinchu, Taiwan
65. Te-Chung Wang, Zheng-Hong Lee, Chang-Cheng Chuo, Min-Ying, TsaiChing-En, Fei-Chang Hwang, Hao-Chung Kuo, and Jim Chi,"AlInGaN Ultraviolet Light Emitting Diode"， Second Asia-Pacific Workshop on Widegap Semiconductors (APWS-2005),March 7-9, 2005, Hsinchu Lakeshore Hotel, Hsinchu, Taiwan.
66. Tsan-Wen Lu and Po-Tsung Lee, "Thermal Characteristics of Two-Dimensional Photonic Crystal Lasers," 1064, *IEEE WOCN'05*, Dubai, UAE (2005)
67. Kuo-Hsi Yen, Hsiao-Wen Zan, Chieh-Ping Ko, Pu-Kuan Liu, Tzu-Yueh Chang, Kuo-Hui Su, Shih-Chiang Wei, Po-Tsung Lee, C. H. Chen, C. M. Yeh, and J. C. Hwang, "Organic thin-film transistors with AlN film as a gate-insulator by RF/ICP Sputtering," *EuroDisplay'05* (2005)
68. Po-Tsung Lee, Hsiao-Wen Zan, Shih-Chiang Wei, Cheng-Chung Lee, Jia-Chu Ho, and T. H. Hu, "Thermal Behavior and Self-Heating Effect in Pentacene-Based Thin Film Transistors," Wed-12-05, *IDMC'05*, Taipei, Taiwan (2005)
69. Y. S. Chang, H. C. Kuo, and S. C. Wang," Improvement of high speed performance for 10-Gb/s 850 nm

VCSELs,” SPIE Photonic West, Conference 5364, paper 5364-10, Jan. 2004

70. F. I. Lai, H. C. Kuo, and S. C. Wang,” Improvement of kink characteristics of proton implanted VCSEL with ITO overcoating,” SPIE Photonic West, Conference 5364, paper 5364-28, Jan. 2004
71. F. I. Lai, C. F. Chu, J. T. Chu, C. C. Yu, C. F. Lin, H. C. Kuo, and S. C. Wang, “Improvement of high power and high current operation of GaN lught emitting diodes by laser lift-off technique,” *CLEO 2004*, CWA29 2004
72. S. C. Wang, “Fabrication and emission characteristics of p-GaN and GaN multiple quantum well nanorods,” 2004 US Airforce & Taiwan Nanoscience Initiative Workshop, paper C5, Feb. 2004
73. T. H. Hsueh, Y. H. Chang, F. I Lai, H. W. Hung, M. C. Ou-yang, C. W. Chang, H. C. Kuo, and S. C. Wang, “Fabrication and emission characteristic of InGaN/GaN multiple quantum wells nanorods,” *CLEO 2004*, IWA20
74. H. C. Kuo, C. F. Chu, J. T. Chu, Fang-I Lai, C. C. Yu, C. F. Lin, and S. C. Wang “ Fabrication of p-side down GaN Vertical Light Emitting Diodes on Copper Substrates by Laser Lift-off” ISBLLED 2004
75. H. C. Kuo, Y. S. Chang, F. Y. Lai, T. H. Hsueh, L. H. Lai, and S. C. Wang, “High speed Perfromance of 850 nm InGaAsP/InGaP strain-compensated VCSELs”, SPIE Proceeding 2004 (EI)
76. Y. H. Chang, H. C. Kuo, M. Y. Tsai, S. C. Wang, N. Tansu, J. Y. Yeh, L. J. Mawst, “Temperature dependent photoluminescence of highly strained InGaN/GaAs Quantum Well(λ=1.28-1.45 μm) with GaAsP strain-compensated layer”, SSDM International Cconference, pp82-83, Sep. 2004
77. Y. H. Chang, H. C. Kuo, F. I. Lai, Y. A. Chang, P. T. Lee, S. C. Wang and L. H. Laih, “Fabrication of High Speed Single Mode 1.27 μm InGaAs:Sb-GaAsP Quantum Wells Vertical Cavity Surface Emitting Laser”, SSDM International Cconference, pp. 930-931, Sep. 2004
78. T. H. Hsueh, H. W. Huang, C. C. Kao, Y. H. Chang, M. O. Yang, H. C. Kauo and S. C. Wang, “InGaN/GaN Multi-Quantum-Well Nanorods Fabricted by Plasma Etching Using Self-assembled Nickel Nano-masks”, SSDM International Cconference, pp. 882-883, Sep. 2004
79. F. I. Lai, J. T. Chu, C. F. Chu. W. D. Liang, H. C. Kuo and S. C. Wang, “Fabrication of large-area GaN Certical Light Emitting Diodes on Copper Substrates by Laser Lift-off”, SSDM International Cconference, pp. 806-807, Sep. 2004
80. Jung-Tang Chu, Wen-Deng Liang, Chen-Fu Chu, H.C. Kuo, and S. C. Wang, “Large Emitting Area GaN Based Light Emitting Diode Fabricated on Conducting Copper Substrates”, accepted by LEOS, 2004
81. Chih-Chiang Kao, J. T. Chu, H. W. Huang, Y. C. Peng, C. C. Yu, Y. L. Hseih, C. F. Lin, H. C. Kuo, and S. C. Wang, “InGaN-Based Light-Emitting Diode With Undercut Side wall”, accepted by LEOS, 2004
82. Hung-Wen Huang, Tao-Hung Hsueh, Chih-Chiang Kao, Ya-Hsien Chang, Miaochia Ou-Yang, Hao-Chung Kuo and Shing-Chung Wang, “Fabrication of InGaN multi-quantum-well nanorod by Ni nano-mask”, accepted by LEOS, 2004
83. H. C. Kuo, Y. A. Chang, G. W. Chang, M. Y. Tsai, and S. C. Wang C. T. Liang, and Y. F. Chen, "Effect of Sb incorporation on optical properties of InGaAsN/GaAsN rrown by MOCVD, PE-71, 2004
84. M. Y. Tsai[1], H. C. Kuo[1]*, Y. H. Chang[1], Y. A. Chang[1], S. C. Wang[1], N. Tansu[2], Jeng-Ya Yeh[3], Luke J. Mawst[3,] "Temperature Dependent Photoluminescence of highly Strained InGaAsN/GaAs Quantum Well (λ=1.20-1.45 μm) with GaAsP Strain-compensated Layer", TICON 2004
85. T. H. Hsueh, Y. H. Chang, Fang-I Lai, H. W. Huang, M. C. Ou-yang, C. W. Chang, H. C. Kuo, S. C. Wan , "Fabrication and emission characteristic of InGaN/GaN multiple quantum wells nanorods", 2004
86. H. H. Yao, Y. S. Chang, M. C. Ou-yang, C. F. Lin, H. C. Kuo*, S. C. Wang, “Formation and Characteristic of GaN Quantum Dots by Self-assembled Nanoholes”, 2004

C. Volume Holographic Materials, Technology and Enabling devices

1. Ken Y. Hsu, Shiuan-Huei Lin, Yi-Nan Hsiao, and Po-Lin Chen, "Fabrication and Characterization of poly (methyl methacrylate) photopolymer doped with quinone-based photosensitive molecules for volume holographic recording," (invited talk) **Paper ThH1-1,** The 7th Pacific Rim Conference on Lasers and Electro-Optics, Seoul, Korea, August 26 - 31, 2007
2. Shiuan-Huei Lin, Yi-Nan Hsiao, and Ken Y. Hsu, "PMMA-based photopolymer materials for holographic data storage," IEEE LEOS - Summer Topicals 2007, Port land, USA, July 23-25, 2007
3. Shiuan-Huei Lin and Ken Y. Hsu," Low-Shrinkage Doped PMMA Photopolymer for Holographic Data Storage Applications", (invited talk), conference proceeding, p. 86, 6th International Syposium on Modern Optics and its applications, Bandung, August, 6-10, 2007.
4. Shiuan-Huei Lin, Polin Chen, and Ken Yuh Hsu, "Fabrication and characterization of phenanthrenequinone-doped copolymers materials for volume holographic memory," Paper 5.5, International Forum on Holography Expo-2007, Moscow, 25-27, September, 2007.
5. Ken Yuh Hsu, Yi-Nan Hsiao, and Shiuan-Huei Lin, "Investigation on new doped PMMA photopolymers and their applications on multiplexed holograms," Paper 5.6, International Forum on Holography Expo-2007, Moscow, 25-27, September, 2007.
6. Chun-I Chuang, Shiuan Huei Lin, and Yu-Faye Chao, "Real-time measurement of PQ:PMMA photopolymer by phase modulated ellipsometer" Paper 5.7, International Forum on Holography Expo-2007, Moscow, 25-27, September, 2007.
7. Ken Y. Hsu, "Photorefractive and photopolymer materials for volume holographic recording," (Invited) 5th International Symposium on Modern Optics and Its Applications (ISMOA 2005), Bandung, Indonesia, 15-20 August, 2005.
8. Vera Marinova, Shiuan Huei Lin and Ken Yuh Hsu, "Role of Ruthenium on Optical, Photoelectrical and Holographic Properties of Bi12TiO20 and Bi12SiO20 Crystals", Paper MPC-1, Photorefractive Effects, Materials and Devices, June 19-23, 2005, Sanya, China.
9. Vera Marinova, M. Gospodinov, Shiuan Huei Lin and Ken Yuh Hsu, "Crystal Growth and Optical Properties of Relaxor Ferroelectric Pb2ScTaO6 Crystals Doped with Ru and Rh", Paper MPC-2, Photorefractive Effects, Materials and Devices, June 19-23, 2005, Sanya, China.
10. Vera Marinova, Shiuan Huei Lin and Ken Yuh Hsu, "Light-induced and holographic properties of Fe, Mn and Fe+Mn doubly doped Bi4Ge3O12 crystals", Paper MPC-4, Photorefractive Effects, Materials and Devices, June 19-23, 2005, Sanya, China.
11. Ken Y. Hsu, Vera Marinova and Shiuan Huei Lin, "Bi12TiO20:Ru Crystals for two-wavelength holographic recording", (Invited paper), Photorefractive Fiber and Crystal Devices: Materials, Optical Properties, and Applications X, San Diego, USA, 31 July-4 August, 2005.
12. Shiuan-Huei Lin and Ken Y. Hsu, "Investigations on doped PQ:PMMA photopolymers for volume holographic recording", Photorefractive Fiber and Crystal Devices: Materials, Optical Properties, and Applications X, San Diego, USA, 31 July-4 August, 2005.
13. Yi-Nan Hsiao, June-hua Lin, Shiuan Huei Lin, and Ken Y. Hsu, "Volume holographic storage characteristics on Znic Methyl Acrylate / PhenanthreneQuinone Codoped Poly(Methyl Methacrylate) Photopolymers", Paper PA17, International Conference on Holography, Optical Recording and Processing of Information, Varna, Bulgaria, 21-25 May, 2005.
14. P. Petkova, V. Marinova, T. Dimov, I. IlievS. H. Lin, and K. Y. Hsu, "Light-induced and holographic properties of transition elements doped BGO crystals", Paper PA20, International Conference on Holography, Optical Recording and Processing of Information, Varna, Bulgaria, 21-25 May, 2005.

15. Shiuan Huei Lin, Vera Marinova and Ken Yuh Hsu, “Doped Bi12TiO20 and Bi4Ge3O12 photorefractive crystals for holographic applications”, (Invited paper) Paper LA06, International Conference on Holography, Optical Recording and Processing of Information, Varna, Bulgaria, 21-25 May, 2005.
16. Ren-Chung Liu and Ken-Yuh Hsu, “Distortion-invariant optical pattern recognition by using binary phase-only synthetic discriminant function (BPOSDF) filter”, International Conference on Holography, Optical Recording and Processing of Information (Holography 2005), Varna, Bulgaria, 21-25 May, 2005.
17. Shiuan-Huei Lin, and Ken Y. Hsu, “Investigation on new PQ:PMMA photopolymers for holographic recording”, (Invited paper) Global Perspectives in Frontiers of Photonics, Computational Imaging, Biophotonics and Nanophotonics, May 18-20, 2005, Duke university, USA..
18. Shiuan-Huei Lin, Yi-Nan Hsiao, Wha Tzong Whang, and Ken Y. Hsu, “Studies on doped PQ:PMMA photopolymers for holographic recording,” (Invited), Optical Information Processing Technology, Photonics Asia, November 8-11, 2004, Beijing, China.June-hua Lin, Yi-Nan Hsiao, Shiuan Huei Lin, and Ken Y. Hsu, “Experimental characterization of phenanthrenequinone-doped copolymer for volume holographic storage”, Paper PA12, International Conference on Holography, Optical Recording and Processing of Information, Varna, Bulgaria, 21-25 May, 2005.
19. Wei-Sheng Cheng; Wha-Tzong Whang; Yu-Chia Chang; Po-Lin Chen; Yi-Nan Hsiao; Shiuan-Huei Lin, “Effect of doping metal ion on holographic storage characteristics of PQ/poly(hydroxyethyl methacrylate-co-methyl methacrylate) hybrids,” Proceedings of SPIE 6620, 6620321-6620328, July, 2007.
20. Shiuan Huei Lin, Vera Marinova, Suzanne Piquet, and Ken Y. Hsu, “Light-induced properties of Bi12TiO20 crystals for two-center recording,” 9-10, Proceeding, EOS Topical Meeting Optics in Computing 2004, Engelberg, Switzerland, April 21-23, 2004.
21. Shiuan Huei Lin, “Doped PMMA photopolymer for volume holographicapplications,” 125-126, Proceeding, EOS Topical Meeting Optics in Computing 2004, Engelberg, Switzerland, April 21-23, 2004.
22. Ken Y. Hsu, Shiuan Huei Lin, and Vera Marinova, “Dynamic Intensity, polarization, and phase holograms,” Paper 14B1-1(Invited), ICO’04 International Conference Optics & Photonics in Technology Frontier, 12-15 July, 2004, Tokyo, Japan.
23. Yi-Nan Hsiao, Wha Tzong Whang, Shiuan Huei Lin, and Ken Y. Hsu, “Holographic characteristics of organo-metallic compound doped PQ:PMMA photopolymers,” Paper 5560-05 (Invited), Photorefractive Fiber and Crystal Devices: Materials, Optical Properties, and Applications IX, Denver, USA, 2-3 August, 2004.

[Domestic Conferences]

A. Coherent and THz Photonics

1. Ru-Pin Pan, Cho-Fan Hsieh, Chao-Yuan Chen, and Ci-Ling Pan, Application of Nematic Liquid Crystal for Terahertz Waves,” **invited talk**, presented at The Annual Meeting of ROC Taiwan Liquid Crystal Society, Taipei, Taiwan, December 17, 2004.
2. 謝卓帆、趙如蘋、潘犀靈，藉由液態晶體來調變光子晶體在兆赫波段下異常穿透率之峰值，ibid..
3. 林家任,趙如蘋,紫外光照射配向膜之液晶光配向方法及性質研究,ibid..
4. Tze-An Liu (劉子安), Zu-sho Chow, Jia-Huey Tsao, Teh-Ho Tao, Chao-Yuan Chen, Cho-Fan Hsieh, Sheng-Lung Wu, Ru-Pin Pan, and Ci-Ling Pan, “THz spectroscopic studies of deoxyhemoglobin”, F-SU-III 4-5, presented at OPT2004 (Optics and Photonics Taiwan), Dec.18-19, 2004, Taipei, Taiwan.
5. Yi-Fan Lai (賴奕帆), Yu-Ping Lan, and Ci-Ling Pan, “A study of 16-channel optical demultiplexer for DWDM with liquid crystal enabled functionalities”, ibid., B-SA-VII 1-5.

6. P.L. Chen (陳沛霖), Y. P. Lan, and C.L. Pan, "Frequency Stabilization Of A DFB Laser Diode Using A Fiber Bragg Grating", ibid., C-SU-IV 3-2.
7. Cheng-Yao Kao (高禎佑), Hsueh-Chih Chang, Tze-An Liu, and Ci-Ling Pan, "Towards THz frequency metrology: Phase locking of a pair of semiconductor laser diodes and the femtosecond frequency comb," ibid., C-SU-IV 3-5.
8. Cheng Lo (羅誠), Chih-Yang Wang, and Ci-Ling Pan, "Metallic photonic crystals for controlling terahertz radiation", ibid., C-SA-Ⅳ2-5.
9. Chao-Jen Huang (黃照仁), Ping-Chi Chiang, Tze-An Liu, and Ci-Ling Pan, "Coherence Properties Of Continuous Wave Thz Radiation Generated By Photomixing On Substrates Of Different Carrier Lifetimes", ibid., PC-SA1-04.
10. Sheng-Lung Wu (吳勝隆), Tze-An Liu, Zu-sho Chow, Jia-Huey Tsao, Teh-Ho Tao, and Ci-Ling Pan, "Burn-Depth Detection Of Pork With T-Ray Technology", ibid., PF-SA2-02, (2004年光電科技研討會壁報論文獎).
11. I-Hsiang Chiu, Ming-Chung Wu, Zu-De Gong, Gong-Cheng Lin, Jy-Wang Liaw, and Gong-Ru Lin, "1.8-ps Mode-Locked Semiconductor Optical Amplifier Fiber Laser Pulse Generated by 60-ps Backward Optical Dark Pulse Injection", ibid., C-SA-IV1-2.
12. Ming-Chung Wu, Yung-Cheng Chang, Gong-Cheng Lin, Jy-Wang Liaw, and Gong-Ru Lin, "Suppression of Phase Noise and Supermode Noise in Harmonic Mode-Locked Erbium-Doped Fiber Laser Using Semiconductor Optical Amplifier", ibid., C-SA-IV2-3.
13. Chun-Jung Lin, Yu-Lun Chueh, Li-Jen Chou, and Gong-Ru Lin, "Silicon Nanocrystals Synthesized by CO2 Laser Annealing of Si-Rich SiO2", ibid., A-SA-I1-5.
14. Yung-Cheng Chang, Yu-Huang Lin, J. H. Chen, and Gong-Ru Lin, "All-Optical OC-192 3R Regeneration Using Optically Gain-Switched Fabry-Perot Laser Diode", ibid., B-SU-VIII4-3.
15. Chi-Kuan Lin, Hao-Chung Kuo, M. Feng, Gong-Cheng Lin, Chong-Long Ho, and Gong-Ru Lin, "A Low-Dark-Current InGaAs Photodetector Made on Metamorphic InGaP Buffered GaAs Substrate", ibid., A-SU-III11-6.
16. Chia-Yang Chen, Chun-Jung Lin, Gong-Ru Lin, Hao-Chung Kuo, Yu-Lun Chueh, Li-Jen Chou, Chih-Wei Chang, and Eric Wei-Guang Diau, "Near-Infrared Luminescence of PECVD-Grown Si-Rich SiOx with Buried Si Nanocrystals", ibid., A-SU-II10-7.
17. Chi-Kuan Lin, Chun-Jung Lin, and Gong-Ru Lin, "Silicon Defect and Nanocrystal Related White-Light and Near-Infrared Electroluminescence of Si-Rich SiO2 Based Metal-Oxide-Semiconductor Diode", ibid., PA-SA1-10.
18. Kuo-Cheng Yu1, Chi-Kuan Lin, Chun-Jung Lin, Chih-Wei Chang, Eric Wei-Guang Diau and Gong-Ru Lin, "Time-Resolved Photoluminescence and Capacitance-Voltage Analysis of Neutral Oxygen Vacancy Defect in Si Implanted SiO2 on Si Substrate", ibid., PA-SA1-50.
19. Yu-Sheng Liao, and Gong-Ru Lin, "all-optical clock recovery efficiency from pattern effect by using mode-locked semiconductor optical amplifier fiber laser", ibid., PC-SA1-10.
20. Yu-Huang Lin, Kun-Chieh Yu, and Gong-Ru Lin, "Mode Beating Noise Suppression of a Mutually Injection-Locked Fabry-Perot Laser Diode and Erbium-Doped Fiber Amplifier Link", ibid., PB-SU1-02.
21. Yu-Huang Lin and Gong-Ru Lin, "Theory of a Mutually Injection-Locked Fabry-Perot Laser Diode and Erbium-Doped Fiber Amplifier Link", ibid., PB-SU1-70.
22. Yu-Huang Lin, Yung-Cheng Chang, J. H. Chen, and Gong-Ru Lin, "An Injection-Locked Fabry-Perot Laser Diode Based Pseudo-Return-to-Zero Data Format Generator", ibid., PB-SU1-13.
23. Kuo-Cheng Yu, Chi-Kuan Lin, Hong-Zhi Xie, Chun-Jung Lin, Tze-An Liu, Ci-Ling Pan, and Gong-Ru Lin, "Si-Nanocrystal-Enhanced Photoconductivity of Silicon-Implanted Quartz", ibid., PA-SA1-51.
24. C. K. Lee (李晁逵) , C. L. Chiun (莊沁融), C. H. Wu (吳宗翰) , and C. L. Pan (潘犀靈), "High resolution full field characterization of ultrafast pulse with pulse synthesizer," paper PE52, presented at Annual Meeting of the Physical Society, Feb. 9-11, 2004, Kaoshiung, Taiwan, in Conference Proceedings, 物理雙月刊, Vol. 27, No. 1,

February 2005, p. 214.

25. S. L. Wu (吳勝隆) and T. A. Liu (劉子安) and C. L. Pan (潘犀靈), “Spectroscopy of flour, lactose and starch in the THz range,” paper PE64, presented at Annual Meeting of the Physical Society, Feb. 9-11, 2004, Kaoshiung, Taiwan, in Conference Proceedings, 物理雙月刊, Vol. 27, No. 1, February 2005, p. 217.
26. Cheng Lo(羅誠), Cho-Fan Hsieh, Ru-Pin Pan and Ci-Ling Pan, “Effects of Hole Material on Enhanced Terahertz Transmission through Metallic Hole Arrays”, C-FR-V 1-2, presented at OPT2005 (Optics and Photonics Taiwan), Dec. 9-10, 2005, Tainan, Taiwan.
27. Ching-Wei Chen (陳晉瑋), Wen-Jr JIANG and Ci-Ling Pan, “Phase Retrieval Of Ultrafast Optical Pulses From Interferometric Autocorrelation Measurement By Population-Split Genetic Algorithm (PSGA) ,” C-FR-V2-7, ibid. (2005 年光電科技研討會學生論文獎)
28. Tzung-Han Wu(吳宗翰), Chin-Rung Chung, Chao-Kuei Lee and Ci-Ling Pan, “Enhancement of Tera-Hertz Radiation by modulation of carrier dynamics with optical pulses in photoconductive antennas,” C-FR-V2-8, ibid.
29. Tze-An Liu(劉子安) , Chao-Jen Huang, Teh-Ho Tao, Ci-Ling Pan, “THz Radaition From An Array Of Three Photoconductive Dipole Antennas,” C-SA-V4-1, ibid.
30. Cho-Fan Hsieh(謝卓帆), Tsung-Ta Tang, Hung-Lung Chen, Ru-Pin Pan and Ci-Ling Pan “Voltage Controlled Liquid-Crystal-Based Quarter Wave Plate for THz wave,” C-SA-V4-5, ibid.
31. Tze-An Liu(劉子安) , Sheng-Lung Wu, Ci-Ling Pan, “Birefringence Measurement In Burned And Unburned Porcine Skin By THz Time Domain Spectroscopy,” C-SA-V5-4, , ibid.
32. Cheng-Yao Kao(高禎佑), Chih-Yu Wang, Yu-Ping Lan, Chao-kuei Lee, Jin-Long Peng, Ci-Ling Pan, “Towards Thz Frequency Metrology Ⅲ: Frequency Locking Of Two Laser Diodes To The Femtosecond Frequency Comb,” C-SA-V6-7, , ibid.
33. Ching-Wei Chen (陳晉瑋), Yu-Kuei Hsu , J. Y. Huang , C. S. Chang , Jing-Yuan Zhang and Ci-Ling Pan, “Generation And Applications Of Intense Picosecond Infrared Light Source Tuning From 2.4 μm To 38 μm,” C-SA-V5-3, , ibid.
34. Wen-Jr JIANG(江文智), Ching-Wei Chen , and Ci-Ling Pan, “Pulse Reconstruction From Frequency-Resolved Optical Gating Measurement By Use Of Population-Split Genetic Algorithm (PSGA),” PC-FR2-05, , ibid.
35. Tzung-Han Wu(吳宗翰), Chin-Rung Chung, Chao-Kuei Lee and Ci-Ling Pan, “The Application of Pulse Shaping in THz Waveform Synthesis,” PC-FR2-14, , ibid.
36. Yu-Tai Li(黎宇泰), Yu-Ping Lan, Yea-Feng Lin, Ru-Pin Pan, Chao-Kuei Lee, Ci-Ling Pan, “Liquid Crystal Layer Thickness Measurement By Monitoring Wavelength Change Of An External Cavity Laser Diode,” PC-FR2-07, ibid..
37. Tze-An Liu(劉子安) , Sheng-Lung Wu, Ci-Ling Pan, “Burn-Depth Detection Of Pork With T-Ray Technology,” PF-FR2-30, , ibid..
38. Yi-Chao Wang(王怡超), Kuan-Wen Chen, Ci-Ling Pan, Jia-Min Shieh, Zun-Hao Chen, and Bau-Tong Dai, “Blue Femtosecond Laser-Induced Crystallization of Amorphous Silicon for TFT Applications,” PA-FR1-082, ibid.
39. Ci-Ling Pan, “A Liquid-Crystal-Based Terahertz Tunable Lyot Filter,” invited talk, presented at the annual meeting of the Liquid Crystal Society, Taiwan, Republic of China （中國液態晶體學會）, December 30, 2005, Hsinchu, Taiwan.
40. 洪國騰,林家任,趙如蘋,溫度控制下之紫外光配向方法及性質研究,” ibid..
41. Yu-Tai Li, Yu-Ping Lan, Yea-Feng Lin, Ru-Pin Pan, Chao-Kuei Lee, Ci-Ling Pan And Chih-Yu Wang,” Measurement Of Liquid Crystal Layer Thickness By Monitoring Wavelength Change of An External Caviety Layser Diode” ibid..
42. Hsin-Ying Wu and Ru-Pin Pan, “Comparison of Polar Anchoring Strength between the Ion-Beam Bombarded and Rubbed Polyimide Films with a Modified High-Electric-Field Technique”, ibid..
43. Cho-Fan Hsieh, Ru-Pin Pan, and Ci-Ling Pan, “Control of THz Frequency through Two-Dimensional Hexagonal Metallic Photonic Crystal”, presented at The Annual Meeting of The Physical Society of Republic of China, Kaohsiung, Taiwan, February 1-3, 2005.

44. Chia-Jen Lin, Tsung-Ta Tang, and Ru-Pin Pan, "Photo-induced Alignment of Polyimide with UV-Laser and Xenon Arc Lamp," ibid..
45. Hsin-Ying Wu and Ru-Pin Pan, "Polar Anchoring Strength of Ion-Beam Bombarded Polyimide Film," ibid..
46. Cho-Fan Hsieh, Tsung-Ta Tang, Hung-Lung Chen, Ru-Pin Pan and Ci-Ling Pan, "Electrically Controlled Liquid-Crystal-Based Terahertz Phase Shifter and Quarter Wave Plate", ibid..
47. Gong-Ru Lin, "Retrospect on the Research of Silicon Nanocrystal Embedded Silicon Oxide Materials and Light-Emitting Devices in NCTU/IEO", *3rd Symposium on Nanophotonics Science and Technology*, Hwalian, Taiwan, September 13-17, 2005.
48. Ci-Ling Pan, "兆赫液晶光學," invited talk, presented at 光學工程研討會 Optical Engineering Forum -- Meet SPIE Fellows, 14 February 2006, Chun-Li, Taiwan.
49. Nai-Chin Hsu 許乃今, Ching-Wei Chen 陳晉瑋, Jung Y. Huang 黃中垚 and Ci-Ling Pan 潘犀靈, "Correlation among spectral components in broadened spectrum generated by shaped femtosecond laser pulses in a single mode fiber," paper PF-57, presented at Annual Meeting of the Physical Society, Feb. 9-11, 2004, Taipei, Taiwan, in Conference Proceedings, 物理雙月刊, Vol. 28, No. 1, February 2006, p. 289.
50. Cao-Kuei Lee 李晁逵, C. C. Hsu 許家誠, C. H. Wu, 吳宗翰 and Ci-Ling Pan 潘犀靈, "Study of ultrafast nonlinear pulse shaping effect of strained saturable Bragg reflector (SSRB) with coherent quantum control technique," paper PF-70, presented at Annual Meeting of the Physical Society, Feb. 9-11, 2004, Taipei, Taiwan, in Conference Proceedings, 物理雙月刊, Vol. 28, No. 1, February 2006, p. 293.
51. Ci-Ling Pan, "A Brief Overview of Photonics Program at NCTU and selected THz topics," invited talk, presented at 海峽兩岸交大研討會, March 15-16, 2006, Hsinchu, Taiwan.
52. Yu-Tai Li, Wei-Wen Wang, Ci-Ling Pan, "Sub-Thz Photonic- Transmitters Based On Separated- Transport-Recombination Photodiode And Micromachined Slot Antenna," Paper AO-40, presented at OPT2006 (Optics and Photonics Taiwan), Dec.15-16, 2006, Hsinchu, Taiwan.
53. C.-H. Chiu, Jin-Wei Shi, Yu-Tai Li, Y.-S. Wu, W.-S. Liu, J.-I. Chyi and Ci-Ling Pan, " High-Speed GaAs-AlGaAs Based Unitraveling-Carrier Photodiodes at 830nm Wavelength Regime," Paper BO-23, ibid..
54. Hung-Wen Chen, Ja-Yu Lu, Li-Jin Chen, Po-Jui Chiang, Hung-Chun Chang, Yu-Tai Li , Ci-Ling Pan, Jeng-Liang Kuo and Chi-Kuang Sun, "Terahertz Fiber Coupler," Paper CO-01, ibid..
55. Ching-Wei Chen, Yu-Kuei Hsu, Jung Y. Huang, Chen-Shiung Chang, Ci-Ling Pan, "Generation Properties Of Coherent Infrared Radiation In The Optical Absorption Region Of GaSe Crystal," paper CO-03, ibid..
56. Ja-Yu Lu, Yu-Tai Li, Ci-Ling Pan, Chin-Ping Yu, Hung-Chung Chang, Hung-Wen Chen and Chi-Kuang Sun, "Air-Core Microstructure Fiber For Terahertz Radiation Waveguiding," Paper CO-04, ibid..
57. Tsung-Ta Tang, Hsin-Ying Wu, Chia-Jen Lin, and Ru-Pin Pan, "Precise Determination Of Azimuthal Anchoring Strength For Liquid Crystal Surface Alignment," paper GO-22, ibid..
58. Hung-Wen Chen, Ja-Yu Lu, and Li-Jin Chen, Yu-Tai Li, Ci-Ling Pan, Jeng-Liang Kuo and Chi-Kuang Sun, "Study On Attenuation Spectrum Of Subwavelength-Diameter THz Fibers," paper CP28, ibid.
59. Yu-Sheng Liao and Gong-Ru Lin, "A side-mode injection locked FPLD based 2.5 Gbit/s DWDM-PON with 22-channel capacity", poster paper CO-, ibid.
60. Kun-Chieh Yu, Yu-Sheng Liao, and Gong-Ru Lin, "Semiconductor optical amplifier based all-optical OC-192 RZ data decision gating with dark optical comb injection", Oral paper BO-30, ibid.
61. Gong-Ru Lin, Jun-Yuan Chang, Hai-Han Lu, and Yu-Sheng-Liao, "Sub-picosecond wavelength tunable L-band mode-locked erbium-doped fiber laser", poster paper CP-11, ibid.
62. Gong-Ru Lin and Ying Tsung Lin, "50-fs pedestal-free Gaussian-shape pulse compression with a pre-chirped Er-doped fiber amplifier", poster paper CP-12, ibid.
63. Chun-Jung Lin and Gong-Ru Lin, "Enhancing nanocrystallite Si electroluminescence by suppressing oxygen desorption in high temperature and low-plasmonic-power PECVD", Oral paper AO-67, ibid.
64. Gong-Ru Lin, Yung-Cheng Chang, and Kun-Chieh Yu, "Dynamic chirp reduction of all-optical converted 10Gbit/s RZ data from injection-locked laser diodes," poster paper BP-037, ibid.
65. Kun-Chieh Yu, Yu-Sheng Liao, and Gong-Ru Lin, "Multimode laser diode injection induced gain-shaping in

semiconductor optical amplifier for all-optical 10Gbit/s pulsed RZ generation", Oral paper CO-08, ibid.

66. Gong-Ru Lin, Hao-Chung Kuo, Huang-Shen Lin, and Chih-Chiang Kao, "Effect of rapid annealing condition on size and density of self-assembled Ni nanodots on SiO2/Si", poster paper AP-022, ibid.
67. Gong-Ru Lin, Chi-Kuan Lin, and Chun-Jung Lin, "Fowler-nordheim tunneling enhanced electroluminescence in a Si nanocrystal MOSLED with interfacial Si nano-pyramids", oral paper AO-39, ibid.
68. Gong-Ru Lin and Chia Yang Chen, "Improved NIR-to-IR energy transferring efficiency of Si/SiO/Er_2O_3 co-sputtered Si-rich SiO_X:Er^{3+}", poster paper AP-059, ibid.
69. Cho-Fan Hsieh, Genel Farcy, I-Chen Ho, Ru-Pin Pan and Ci-Ling Pan, "The Temperature Dependent Refractive Indices of the Nematic Liquid Crystal 4-(trans-4'-Pentylcyclohexyl)-benzonitrile in the THz Frequency Range," presented at The Annual Meeting of Taiwan Liquid Crystal Society, Tainan, Taiwan, December 22, 2006.
70. Hsin-Ying Wu, Chih-Yu Wang and Ru-Pin Pan, "Study on different alignment modes of nematic liquid crystals on argon ion beam bombarded polyimide films", ibid..
71. 林家任、黎宇泰、謝卓帆、趙如蘋、潘犀靈，可調制之磁控式兆赫波液晶相位光柵，ibid..
72. 洪國騰,林家任,湯宗達,趙如蘋,液晶於摩刷聚醯亞銨薄膜之光致重新配向研究, 中 ibid..
73. 郭政穎, 湯宗達, 林家任, 趙如蘋, 陽極處理氧化鋁薄膜基板對液晶配向之研究", ibid..
74. 張佳瑩, 湯宗達, 林家任, 趙如蘋, 摩刷配向與紫外光配向之聚亞醯胺薄膜其相位延遲研究及與表面錨定強度之關係, ibid..
75. Chuan-Hsien Lin, Chia-Jen Lin, Ru-Pin Pan, and Ci-Ling Pan, "Photo-aligned Liquid Crystal Cell as an Electrically Controlled Terahertz Phase Grating", presented at The Annual Meeting of The Physics Society of Republic of China, Taiwan, January, 2007.
76. C.W. Chen (陳晋瑋) and C.J. Hsu (許哲睿) and C.L. Pan (潘犀靈) , "兆赫波於硒化鎵晶體中光參數放大之研究," paper CO-001, Optics and Photonics in Taiwan, Nov. 30-Dec.1, 2007, Taichung, Taiwan. (Best Student Paper Award, OPT 2007, 2007 年光電科技研討會學生論文獎)
77. Y.T. Li (黎宇泰) and W.W. Wang (王韋文) and C.L. Pan (潘犀靈) and K.J. Chen (陳克堅) and J.T. Chen (陳錦泰), "低溫成長砷化鎵與多重氧離子佈植砷化鎵光導天線之 THZ 輻射特性之比較," paper CO-004, ibid. (Best Student Paper Award, OPT 2007, 2007 年光電科技研討會學生論文獎)
78. C.S. Yang (楊承山) and I.C. Ho (何宜貞) and C.L. Pan (潘犀靈) and R.P. Chao （趙如蘋), "向列型液晶 E7 在不同溫度下兆赫波段光學常數之研究," paper CP-003, ibid..
79. Y.P. Ku (顧昀浦) and Y.C. Wang (王怡超) C.H. Chuang (莊君豪) and C.L. Pan (潘犀靈) and H.Y. Ahn(安惠榮), "氮化銦的兆赫波光譜研究," paper CP-012, ibid..
80. Y.C. Wang (王怡超) and C.H. Chuang (莊君豪) and Y.P. Ku (顧昀浦) and C.L. Pan (潘犀靈) and H.Y Ahn(安惠榮), "利用光激發-兆赫波探測研究飛秒雷射退火非晶矽,」paper CP-018, ibid..
81. J.Y. Lu (呂佳諭) and C.M. Chiu (邱垂珉) and C.C. Kuo (郭中秋) and C.H. Lai (賴志賢) and H.C. Chang (張宏鈞) and Y.J. Hwang(黃裕津) and C.L. Pan(潘犀靈) and C.K. Sun (孫啟光), "Terahertz Scanning imaging with a Subwavelength Plastic Fiber," paper CP-036, ibid..
82. 賴玉倩, 謝卓帆, 趙如蘋, 潘犀靈, "利用液態晶體之兆赫波偏振器研究," 中國液態晶體學會年會暨研討會 (2007 Annual Meeting of ROC Taiwan Liquid Crystal Society), Chung Yuan Christian University, Chung Li, Taiwan, December 28, 2007.
83. 林俊賢, 林家任, 趙如蘋, 潘犀靈, "可調制之電控式兆赫波液晶相位光柵," ibid..
84. Chih-Yu Wang, Ru-Pin Pan, Song-Shiang Lin, Chein-Dhau Lee," Study on alignment characteristic and surface analysis on S46-F8 film treated by UV irradiation and ion beam bombardment," ibid.
85. Tsung-Ta Tang, Ru-Pin Pan, Yi-Chao Wang, Ci-Ling Pan, "Birefringence and absorption of a ferroelectric liquid crystal in the SmA* and SmC* phases and in the terahertz range," ibid..
86. Chia-Jen Lin(林家任) and Yu-Tai Li(黎宇泰) and Cho-Fan Hsieh(謝卓帆) and Ru-Pin Pan(趙如蘋) and Ci-Ling Pan(潘犀靈), "Tunable Liquid Crystal Phase Grating for Terahertz Beam Splitting," paper AE-05, presented at Annual Meeting of the Physical Society of Republic of China, Jan. 28-30, 2008, Hsinchu, Taiwan.
87. Wei-Jan Chen(陳蔚然) and Jhi-Ming Hsieh(謝智明) and Shu Wei Huang(黃書偉) and Hao-Yu Su(蘇皓瑜) and Tsung-Ta Tang(湯宗達) and Chuan-Hsien Lin(林俊賢) and Chao-Kuei Lee(李兆逵) and Ru-Pin Pan(趙如蘋)

and Ci-Ling Pan(潘犀靈) and A.H.Kung(孔慶昌), "Sub-Single-Cycle Optical Pulse Train with Constant Carrier Envelope Phase," paper BN-05, ibid..

88. Y. S. Lin (林育賢) and C. W. Chen (陳晉瑋) and J. Y. Huang (黃中垚) and H. Ahn(安惠榮) and C. S. Chang (張振雄) and C. L. Pan (潘犀靈) and L. Yan (嚴立) and C. K. Lee (李晁逵), "High field terahertz radiation generated by multi-stage optical rectification", paper PE-02, ibid..
89. J. M. Hsieh (謝智明) and W. J. Chen (陳蔚然) and H. Y. Su(蘇皓瑜) and A. H. Kung (孔慶昌) and T. T. Tang (湯宗達) and C. H. Lin (林俊賢) and R. P. Pan(趙如蘋) and C. L. Pan(潘犀靈), "Phase control with Liquid Crystal Spatial Light Modulator in optical pulse train" , paper PE-11, ibid..
90. H. Ahn (安惠榮) and Y. -P. Ku (顧昀浦) and C.-H. Chuang (莊君豪) and C. -L. Pan (潘犀靈) and H.-W. Lin(林弘偉) and H.-M. Lee(李弘貿) and S. Gwo (果尚志), "Strong terahertz emission from InN nanorod array" , paper PE-12, ibid..
91. M. H. Yang (楊孟桓) and Y. T. Li. (黎宇泰) and Chi Wai Chow (鄒志偉) and Ci Ling Pan (潘犀靈), "利用電光取樣在自由空間下偵測聲光調制之兆赫波通訊傳輸特性," paper PE-16, ibid..
92. Sung-Hui Lin (林松輝), Chao-Kuei Lee (李晁逵), Yi-Sheng Lin (林易聲), Shin-Cheng Liu (劉信成), and Ci-Ling Pan (潘犀靈), "A Study of Excitation Dynamics of Saturable Bragg Reflector: A Possible Alternative Approach for High Repetition Rate Mode-Locked Laser," paper PE-29, ibid. (Best Poster Paper Award, Honorable Mention 壁報論文佳作獎).
93. Sheng-Lan Hsu (許勝嵐) and Cho-Fan Hsieh (謝卓帆) and Tsung-Ta Tang (湯宗達) and Ru-Pin Pan (趙如蘋) and Ci-Ling Pan (潘犀靈), "Temperature-dependent optical constants and birefringence of nematic liquid crystal 7CB in the terahertz frequency range," paper PE-35, ibid..
94. C.W. He(何介暐) and Y.L. Lin(林俞良) and Y.T. Li(黎宇泰) and Ci Ling Pan(潘犀靈) and Hyeyoung Ahn(安惠榮) and K.J. Chen(陳克堅) and K.T. Chan(陳錦泰) , "CW THz Radiation Generated by Oxygen-ion-implanted GaAs Photoconductive Antenna", paper PE-67, ibid..
95. Hsing-Ying Wu and Ru-Ping Pan, "Liquid crystal surface alignments by using ion beam sputtered magnetic thin films" paper PE-22, ibid.
96. Ru-Pin Pan, "Demonstration for damped oscillations with easy to get materials" paper, bO-02, ibid.

B. Quantum (Photonic Crystal) structures and Enabling devices

1. T. W .Liu,L. F. Lin,C. C. Kao,S. W. Chen,T. T. Kao,H. C. Kuo, T. C. Lu, and S. C. Wang, "Study of GaN-based Two Dimensional Surface-emitting Photonic Crystal Distributed Feedback Laser", Optics and Photonics Taiwan, Dec. 2007.
2. Y. T. Lee,T.S.Ko,T.C.Wang,R.C.Gao,M.H.Lo,J.R.Chen, T. C. Lu, H. C. Kuo, and S. C. Wang, " optical characteristics of a-plane InGaN/GaN multiple quantum well with different width", Optics and Photonics Taiwan, Dec. 2007.
3. P. C. Lin, M. H. Lo, T. C. Lu,H. C. Kuo, and S. C. Wang, " Optical Properties of InGaN/GaN LED Grown on Misorientation Sapphire Substrate", Optics and Photonics Taiwan, Dec. 2007.
4. C. E. Hsieh , S. G. Lin ,H. C. Kuo, T. C. Lu, and , F. I. Lai," Light output efficiency enhancement of InGaN-based Micro-Hole LEDs structure by Photoelectrochemical (PEC) oxidation", Optics and Photonics Taiwan, Dec. 2007.
5. B.S. Cheng, C.E. Lee, M.R. Tsai, H. C. Kuo, T. C. Lu, and S. C. Wang, " Enhancement of Flip-Chip Light Eitting Diodes with Textured Micropillar Arrays", Optics and Photonics Taiwan, Dec. 2007.
6. P. Y. Su, J. R. Chen, T. C. Lu,H. C. Kuo, and S. C. Wang, " Numerical study on optimization of active layer structures for GaN/AlGaN multiple-quantum-well laser diodes", Optics and Photonics Taiwan, Dec. 2007.
7. C.E. Yeh,P. C. Peng ,R. Xuan,G. Lin,C. T. Lin ,H. C. Kuo, S.Chi, T. C. Lu, S. C. Wang and J. Y. Chi, " Relative Intensity Noise Characteristics of Long-Wavelength Quantum Dot VCSEL", Optics and Photonics Taiwan, Dec. 2007.

8. J.Da Huang,Y.T. Lin, J.M. Shieh, H. C. Kuo, Chih Chen ,T. C. Lu, and S. C. Wang, " Enhanced Hole-Mobility and Reliability of Panel Epi-Like Silicon Transistors Using Backside Green LA", Optics and Photonics Taiwan, Dec. 2007.
9. S.F.Yang,Y.A.Chang,H. C. Kuo, T. C. Lu, and S. C. Wang, " Design and Fabrication of Concentrated Single-Junction GaAs Solar Cell", Optics and Photonics Taiwan, Dec. 2007.
10. C.H. Chiu, H.W. Huang,H. C. Kuo, T. C. Lu and S. C. Wang, " Fabrication of InGaN/GaN MQW Nanorods LED by ICP-RIE and PEC oxidation Process with Self-Assembly ni Metal Islands", Optics and Photonics Taiwan, Dec. 2007.
11. J.R. Chen, Y.C..Wu, T. C. Lu , Y.K. Kuo,H. C. Kuo , and S. C. Wang, " Numerical Study on Lateral MODE BEHAVIOR OF 660-nm AlGaInP LASER DIODES", Optics and Photonics Taiwan, Dec. 2007.
12. M. H. Lo, S.W.Chen ,T. C. Lu,H. C. Kuo, and S. C. Wang, " Atomic Layer Deposition of AlGaN/GaN Multiple Quantum Wells by MOCVD", Optics and Photonics Taiwan, Dec. 2007.
13. Shih-Chun Ling, Te-Chung Wang, Tsung-Shine Ko**,** T. C. Lu **,** H. C. Kuo, and S. C. Wang, " Characteristics of ultraviolet nonpolar InGaN/GaN emitters using trench epitaxial lateral overgrowth", Optics and Photonics Taiwan, Dec. 2007.
14. C.F. Lai, H. C. Kuo, T. C. Lu and S. C. Wang" Anisotropy of light extraction from two-dimensional photonic crystal light-emitting diodes", Optics and Photonics Taiwan, Dec. 2007
15. C. M. Chang, T. S. Ko,H. C. Kuo, T. C. Lu, and S. C. Wang, " Growth Of Non-polar a-plane ZnO Nanostructures And FilmsUsing a-plane GaN Buffer Layer", Optics and Photonics Taiwan, Dec. 2007.
16. T. C. Lu, P-C. Yu, H. C. Kuo, and S. C.Wang, "GaN-based blue microcavity surface emitting lasers", *invited talk*, CSIC-NSC Workshop on Photonics, Hsin-Chu, Taiwan, Nov. 2007
17. Yi-Chun Yang, Yao-Chen Wang, Kung-Shu Hsu, Chung-Chuan Tseng, Po-Tsung Lee, M. C. Wu, and Min-Hsiung Shih, "Mode Identification and Mod Profiles of D4 Photonic Crystal Defect Lasers," AO-035, *OPT'07*, Taichung, Taiwan (2007)
18. Chun-Jung Shih, Jia-Ho Chen, Tsan-Wen Lu, and Po-Tsung Lee, "Modal Analysis of Double Hetero-Structure Photonic Crystal Waveguide-Resonator for In-Plane Emission," BO-032, *OPT'07*, Taichung, Taiwan (2007)
19. Yi-Yu Tsai, Chung-Chuan Tseng, Tsan-Wen Lu, and Po-Tsung Lee, "12-Fold Quasi-Photonic Crystal Microcavity with Central Post," CP-007, *OPT'07*, Taichung, Taiwan (2007)
20. Tsan-Wen Lu, Feng-Mao Tsai, Jyun-Hao Fan, and Po-Tsung Lee, "Beyond Photonic Crystal: High Quality Microcavity Realized by Quasi-Photonic Crystal," T01-04, *SNDT'07*, Hsinchu, Taiwan (2007)
21. S. W. Chen, C. C. Kao , K. F. Yeha, J. T. Chua, W. L. Pengb, H. W. Huanga, T. C. Lua, H. C. Kuoa and S. C. Wang" Characteristics of Nano-Roughened GaN Light-Emitting Diodes Formed by ICP Dry Etching and Laser Lift-off technique"物理年會 2006
22. H. W. Huang, C. F. Lai1, C. C. Kao, J. T. Chu, C. H. Chiu, T. C. Lu1, H. C. Kuo,S. C. Wang, C. C. Yu, and T. H. Hsueh"Optical properties of In0.3Ga0.7N/GaN green nanorods fabricated by plasmaetching with nanoscale nickel metal islands" 物理年會 2006
23. C. H. Chiu, H. W. Huang, H. C. Kuo, J. T. Chu, C. F. Lai, C. C. Kao, T. C. Lu,S. C. Wang, R. J. Tsai, C. C. Yu and C. F Lin"Nitride-Based LEDs with Nano-scale Textured Sidewalls Using Natural Lithography" 物理年會 2006
24. M. H. Lo, G. S. Huang, J. Y. Tsai, H. C. Kuo, T. C. Lu and S. C. Wang "Improvement of efficiency and ESD characteristics of ultraviolet light emitting diodes by inserting AlGaN and SiN buffer layers" 物理年會 2006
25. R.C.Gao,T.S.Ko,T.C.Lu,T.C.Wang,M.H.Lo,J.R.Chen,H.C.Kuo,S.C.Wang" The optical characteristics of different well width from nonpolar InxGa1-xN multiple quantum wells" 物理年會 2006
26. M. R. Tsai, C. E. Lee, Y. J. Lee, J. T. Chu, T. C Lu, H. C. Kuo, and S. C Wang" Flip-Chip Light-Emitting Deiodes With High Reflectance P-Contact Meral and Disk-Array Sapphire Surface" 物理年會 2006

27. G. S. Huang, J. R. Chen, T. C. Lu, H.C. Kuo, S. C. Wang,“ Fabrication of high quality factor hybrid nitride microcavity using highly reflective AlN/GaN and Ta2O5/SiO2 distributed Bragg mirrors“ 物理年會 2006
28. J. T. Chu, M. J. Tsai, L. F. Lin, T. C Lu, H. C. Kuo and S. C. Wang ”Characteristics of Optically Pumped GaN-based Vertical-Cavity Surface-Emitting Lasers” 物理年會 2006
29. L. F. Lin, T. T. Kao, C. C. Kao, J. T. Chu, H. W. Huang, T. C. Lu, H. C. Kuo, and S. C. Wang “Characteristics of High-Q GaN-Based Microcavity Light Emitting Diodes” 物理年會 2006
30. J. R. Chen, H. H. Yao, H. G. Chen, G. S. Huang, T. C. Lu, H. C. Kuo, and S. C. Wang” Suppression of Crack Generation in Asymmetric AlN/GaN Distributed Bragg Reflectors Grown by Metal Organic Chemical Vapor Deposition” 物理年會 2006
31. S. C. Ling, H. G. Chen, H. H. Yao, J. T Chu, N. F. Hsu, T. C. Lu,H. C. Kuo and S. C. Wang” Ultraviolet LEDs with In-rich InGaN/AlGaN Multiple Quantum Wells” 物理年會 2006
32. C. F. Lai, P. Yu, T. C. Wang, H. C. Kuo,T. C. Lu, and S. C. Wang” Ultraviolet Lasing Characteristics of a GaN Photonic Crystal Defect Emitter” 物理年會 2006
33. Y.J. Lee,H.C. Kuo,T.C. Lu,S.C. Wang” High Light-Extraction GaN-based Vertical LEDs With Double Diffuse Surfaces” 物理年會 2006
34. T. S. Ko, T. C. Wang, R. C. Gao, Y. J. Lee, T. C. Lu, H. C. Kuo, and S. C. Wang” InGaN/GaN Nano-stripe Grown on Pattern Sapphire by Metal Organic Chemical Vapor Deposition” 物理年會 2006
35. Tsan-Wen Lu, Feng-Mao Tsai, Po-Tsung Lee, and Tien-Chang Lu, “Octagonal Quasi-Periodic Photonic Crystal Single-Defect Micro-Cavity with Whispering Gallery Mode,” BO-17, *OPT’06*, Hsinchu, Taiwan (2006)
36. Chia-Min Yu, Feng-Mao Tsai, and Po-Tsung Lee, “Dodecagonal Quasi-Periodic Photonic Crystal Lasers with Random Lattice Variation,” CO-09, *OPT’06*, Hsinchu, Taiwan (2006)
37. Chung-Chuan Tseng, Jyun-Hao Fan, and Po-Tsung Lee, “Design and Characteristics of Two-Dimensional Circular Photonic Crystal Lasers,” CP-31, *OPT’06*, Hsinchu, Taiwan (2006)
38. J. Y. Lee, C. Y. Fang, H. C. Kuo, J. M. Shieh, Y. F. Lai , T. C Lu, and S. C Wang” Ultraviolet-visible detectors formed with wide band-gap Si-O nanostructures” 物理年會 2006
39. M. Y. Tsaia(蔡敏瑛), M. Youa (游敏), T. C. Wangb(王德宗) H. C. Kuoa (郭浩中)* and S. C. Wanga (王興宗), “Optical properties of ultra-high-density InGaN quantum dots grown by metalorganic chemical vapor deposition” 物理年會2005.
40. T. H. Hsueh(薛道鴻)a, J. Y. Chu, J. K. Sheub, H. C. Kuoa, S. C. Wang, “Enhancement of light output in InGaN-based microhole array light-emitting diodes,” 物理年會2005.
41. K.F. Yeh , H.W. Huang , J.T. Chu , C.C. Kao , T.C. Lu , H.C. Kuo , and S.C. Wang, “Enhanced Light Output in INGaN/GaN Light Emitting Diodes eith Excimer Laser Etching Surface”, OPT, Dec. 2005
42. G.S. Huang, T. C. Lu, H. H. Yao, H.C. Kuo, and S. C. Wang, “Crack free AlN/GaN distributed Bragg reflectors incorporate with AlN/GaN Superlattices grown by metalorganic chemical vapor deposition”, OPT, Dec. 2005
43. C. P. Chu, T. S. Ko, W. T. Hsu, T. C. Lu, H. C. Kuo, S. C. Wang, “Observation of Strong Red Photoluminescence Emission of Indium Oxy-nitride nanoparticles”, OPT, Dec. 2005
44. W. K. Tsai , P. C. Peng , Y. H. Chang ,M. R. Tsai , H. C. Kuo , and S. C. Wang, “1.3um Quantum Dot VCSEL with light injection”, OPT, Dec. 2005
45. .I-Chen Hsu, H. P. D. Yang, F.I Lai.,T C Lu, H. C. Kuo, S. C. Wang, “High SMSR(>40dB) single-mode output utilizing photonic crystal on proton-implanted vertical-cavity surface-emitting lasers”, OPT, Dec. 2005
46. M. Yu, T. C. Wang, Y. H. Chang, T. H. Hsueh, T. C. Lu, H. C. Kuo,and S. C. Wang, “Optical properties of thermally annealed InGaN/GaN Quantum dots grown by MOCVD”, OPT, Dec. 2005
47. B. J. Su, J. T. Chu, C. C. Kao, H. W. Huang, H. H. Yao, J. Y. Tsai, T. C. Lu, H. C. Kuo and S. C. Wang, “Optical characteristics of optically pumped GaN-based vertical cavity surface emitting lasers”, OPT, Dec. 2005
48. Tsung-Ting Kao, C. C. Kao, Y. C. Peng, J. T. Chu, H. C. Kuo and S. C. Wang, “The lasing behavior of GaN-based vertical cavity surface emitting laser employing AlN/GaN and Ta2O5/SiO2 distributed Bragg reflector”, OPT, Dec. 2005

49. Huang-Sen Lin,. C. C. Kao,. Y. Luo, T C Lu, H. C. Kuo and S. C. Wang, “Self-Assembled Ni Nano-dot on SiO2 Film-A Novel Reactive Ion-Etching Mask For Si Nanorod Formation on Si Substrate”, OPT, Dec. 2005
50. Jr Yau Fang, H. C. Kuo and S. C. Wang, “Emission of Bright Blue Light From Mesoporous Silica with Dense Si nanocrystals”, OPT, Dec. 2005
51. H. H. Yao, G. S. Huang, T. C. Lu, C. Y. Chen, W. D. Liang, H. C. Kuo and S. C. Wang*”Study The Effect of Self-Assembled INGaN/GaN Quantum Dots with Various Interruption Time” , OPT, Dec. 2005
52. Feng-Mao Tsai, Po-Tsung Lee, and Tien-Chang Lu, “Fabrication and characterization of two-dimensional quasi-periodic photonic crystal lasers,” A-FR-I-1-1, *OPT’05*, Tainan, Taiwan (2005)
53. K. F. Tzeng, W. K. Tsai, Y. J. Shiu, H. C. Kuo* and S. C. Wang, “Fabrication of High Speed Single Mode 1.27 µm InGaAs:Sb-GaAsP Quantum Wells Vertical Cavity Surface Emitting Laser” Optics and Photonics Taiwan 2004 (獲得 2004OPT 論文獎)
54. Chuan-Yu Luo, Yi-An Chang, Hao-Chung Kuo, Yen-Kuang Kuo, Shing-Chung Wang “Simulation of InGaN quantum well laser performance using quaternary InAlGaN alloy as electronic blocking layer” Optics and Photonics Taiwan 2004
55. J. Y. Chu, Y. C. Chen, T. H. Hsueh, C. C. Kao, J. K. Sheu H. C. Kuo, S. T. Yen, S. C. Wang” MECHANISM OF ENHANCED LIGHTEXTRACTION IN III-NITRIDE MICRO-HOLE ARRAY LIGHT-EMITTING DIODES” Optics and Photonics Taiwan 2004
56. Y.C. Peng (彭裕鈞), C.C. Kao (高志強), J.Y.Tsai (蔡睿彥), C.F.Lin (林佳峰), H.C.Kuo (郭浩中) and S. C. Wang (王興宗)” Fabrication and characteristics of InGaN/GaN vertical cavity light emitting diodes” Optics and Photonics Taiwan 2004
57. W. D. Liang(梁文燈), J. T. Chu(朱榮堂), F. I. Lai(賴芳儀), C. F. Chu(朱振甫),H. C. Kuo(郭浩中), S. C. Wang(王興宗)” Performance of p-side down GaN based light-emitting-diodes on Cu substrates with different patterns of n-electrode pad” Optics and Photonics Taiwan 2004
58. Min-Ying Tsai(蔡敏瑛), Min You(游敏), Te Chung Wang(王德宗) H.C. Kuo(郭浩中) and S. C. Wang(王興宗)” OPTICAL PROPERTIES OF ULTRA-HIGH-DENSITY INGAN QUANTUM DOTS GROWN BY METALORGANIC CHEMICAL VAPOR DEPOSITION” Optics and Photonics Taiwan 2004
59. Y. T. Wang(王蕙婷), H. H. Yao(姚忻宏), Y. S. Chang(張亞銜), T. H. Hseuh(薛道鴻), H. C. Kuo(郭浩中) and S. C. Wang(王興宗)” Optical Characteristics of of GaN Quantum Dots Grown on AlN Nanoholes by Metal-organic Chemical Vapor Deposition” Optics and Photonics Taiwan 2004, PA-SA1-02.
60. C. P. Chu, M. Y. Tsai1, H. C. Kuo, Fang-I Lai1, Y. H. Chang1, S. Y. Kuo1, S.C. Wang, N. Tansu, Jeng-Ya Yeh and Luke J. Mawst” TEMPERATURE DEPENDENT PHOTOLUMINESCENCE OF HIGHLY STRAINED InGaAsN/GaAs QUANTUM WELL (λ=1.28-1.45µm) WITH GaAsP STRAIN-COMPENSATED LAYER” Optics and Photonics Taiwan 2004
61. Y.C. Lin (林永昌), A.T. Cho (卓恩宗) , Y.F. Lai (賴一凡) ,J.M. Shieh (謝嘉民), H.C. Kuo (郭浩中), S. C. Wang (王興宗)” Silicon Quantum-dots-embedded Mesoporous Nanoscale Silica as the new type high efficient Photonic Emitters” Optics and Photonics Taiwan 2004.
62. Hung-Wen Huang, Chih-Chiang Kao, Ya-Hsien Chang,Tao-Hung Hsueh Miaochia Ou-Yang1, Hao-Chung Kuo1 and Shing-Chung Wang, “FABRICATION OF INGAN MULTI-QUANTUM-WELL NANOROD BY NI NANO-MASK,” Optics and Photonics Taiwan 2004. (獲得 2004OPT 論文獎)
63. Chih-Chiang Kao(高志強), Y. C. Peng(彭裕鈞), H. W. Huang(黃泓文),J. T. Chu(朱榮堂), C. C. Yu(余長治), C. F. Lin(林佳鋒), H. C. Kuo (郭浩中), and S. C. Wang(王興宗), “The Effect of ~22^{o} Undercut Side wall on the performance of the GaN-Based Light-Emitting Diode”, Optics and Photonics Taiwan 2004.
64. T. H. Hsueh, H. C. Kuo, Y. S. Chang, H. W. Huang, M. C. Ou-yang, C. W. Chang, and S. C. Wang, "Optical and structural properties of In0.3Ga0.7N nanowires", pp-65 物理年會 2004
65. Tsan-Wen Lu and Po-Tsung Lee, "Thermal Characteristics of Two-Dimensional Photonic Crystal Lasers," B-SA-VII-1-6, *OPT’04*, Chungli, Taiwan (2004)

C. Volume Holographic Materials, Technology and Enabling devices

1. 蕭義男、許根玉、林烜輝, "Irgacure 784 光敏感劑摻雜於丙烯基類共聚合高分子之體積全像記錄材料的研製與特性分析", **Paper DO-011,** Optics and Photonics Taiwan '07, Tainan, Taiwan, Nov. 30~Dec. 1, 2007.
2. 劉晟齊、林烜輝, "體積全像光學相干器之理論推導與光學模擬", **Paper DO-013,** Optics and Photonics Taiwan '07, Tainan, Taiwan, Nov. 30~Dec. 1, 2007.
3. 陳柏霖、許根玉、林烜輝, "菲醌摻雜於共聚丙烯基類感光高分子之體積全像記錄材料的研製與全像記錄特性分析", **Paper DO-002,** Optics and Photonics Taiwan '07, Tainan, Taiwan, Nov. 30~Dec. 1, 2007.
4. 林俊華、林烜輝、許根玉、鄭超仁, "廣視角數位全像之系統設計", **Paper DP-002,** Optics and Photonics Taiwan '07, Tainan, Taiwan, Nov. 30~Dec. 1, 2007.
5. 粘容蓉、林烜輝, "穿透式體積全像作為光譜儀分光光柵之模擬與應用", **Paper DP-008,** Optics and Photonics Taiwan '07, Tainan, Taiwan, Nov. 30~Dec. 1, 2007.
6. 林俊華、蕭義男、林烜輝、許根玉, "新穎摻雜PQ之共基底體積全像高分子的製備研究", Paper D-SA-VI 2-3, Optics and Photonics Taiwan '04, JungLi, Taiwan, Dec. 18-19, 2004.
7. 林俊華、蕭義男、林烜輝、許根玉, "9,10-Phenanthrenequinone摻雜共基底感光高分子的體積全像特性研究", Paper PD-FR1-22, Optics and Photonics Taiwan '05, Tainan, Taiwan, Dec. 9-10, 2005.
8. 陳柏霖、蕭義男、林俊華、林烜輝、許根玉, "以PQ衍生物為光敏感劑的感光全像高分子材料製備與特性研究", Paper D-FR-VI 2-6, Optics and Photonics Taiwan '05, Tainan, Taiwan, Dec. 9-10, 2005.
9. 林俊華、蕭義男、林烜輝、許根玉, "摻雜ZnMA 與PQ分子之PMMA的感光高分子塊材的製作與其全像記錄的特性量測", Paper D-SA-VI 4-5, Optics and Photonics Taiwan '05, Tainan, Taiwan, Dec. 9-10, 2005.
10. 方建舜、林俊華、許根玉、林烜輝、莊漢聲、楊正財, "全像式微流檢測", Paper D-SA-VI 2-2, Optics and Photonics Taiwan '04, JungLi, Taiwan, Dec. 18-19, 2004.

2. Patent List

A. Coherent and THz Photonics

Seven Taiwan (ROC) patents granted, two disclosed and two being filed; two U.S. patents granted, one disclosed and four have been filed.

1. Ci-Ling Pan（潘犀靈）, Ru-Pin Chao（趙如蘋）, and Chao-Yuan Chen（陳昭遠）“利用磁場控制液晶雙折射現象之可調兆赫波相移器或相位延遲器”Taiwan (ROC) patent, No. 200186, 2004/04/11 - 2023/07/28.

2. Ci-Ling Pan（潘犀靈）, Ru-Pin Chao（趙如蘋）, and Yu-Ping Lan（藍玉屏）, “具數位及無跳模連續微調波長機制之多波長外腔雷射系統,” Taiwan (ROC) patent, No. I223484, granted November 1, 2004,

3. Ci-Ling Pan（潘犀靈）, Ru-Pin Chao（趙如蘋）, and Yu-Ping Lan（藍玉屏）; A multi-wavelength external-cavity laser with digital and mode-hop-free fine tuning mechanism,” US patents filed on Nov. 16, 2003, No. 10-738,893.

4. Gong-Ru Lin（林恭如）, “發明自耦同步調制技術以量測光接收機之等效靈敏度與誤碼率,” Taiwan (ROC) patent, No. I226762, Jan. 11, 2005.

5. J. Y.HUANG,（黃中垚）, 李建立, “可同時量測光學晶體厚度及光軸之影像式偏極光量測方法,” Taiwan (ROC) patent, No. I232294, May 11, 2005.

6. Ci-Ling Pan（潘犀靈）, Jin-Yuen Zhang（張景園）, Jung Y. Huang 黃中垚, and Chao-Kuei Lee（李晁逵）, “波長可調之藍光飛秒非共線式光參數放大器.” Taiwan (ROC) Patent, No. I239128, granted September 1, 2005.

7. Ci-Ling Pan（潘犀靈）、Yi-Chao Wang（王怡超）、Jia-Min Hsieh（謝嘉民）、Zun-Hao Chen（陳尊豪）、Bau-Tung Dai（戴寶通）, "近紅外波段飛秒雷射在非晶矽退火的應用方法, Near-infrared femtosecond laser-induced crystallization of amorphous silicon," Taiwan (ROC) patent, No. I245321, granted December 11, 2005.

8. Ci-Ling Pan（潘犀靈）, Ru-Pin Chao（趙如蘋）, Min-Jay Huang（黃銘杰） and Yu-Ping Lan（藍玉屏）, "具多種功能之電控液晶式可調光多工器及光解多工器 Multi-functional electrically controlled Liquid crystal based tunable optical multiplexer and demultiplexer," 中華民國專利公告，Taiwan (ROC) patent disclosed August 16, 2006, No. 200628872.

9. Ci-Ling Pan（潘犀靈）, Jin-Yuen Zhang（張景園）, Jung Y. Huang 黃中垚, and Chao-Kuei Lee（李晁逵）, A blue-light generating Femtosecond wavelength-tunable Non-collinear Optical Parametric Amplifier," US patent 7106498 B2, Sept. 12, 2006.

10. Ru-Pin Chao (趙如蘋)，王智杰，吳信穎，黃振昌，張劭儒，吳坤益，寇崇善，李安平，魏孝寬，「一種電漿液晶配向方法與設備」， ROC (Taiwan) patent filed, filing No., 095144561, Nov. 30, 2006.

11. Ru-Pin Chao (趙如蘋), Hsin-Ying Wu, Chih-Chieh Wang, Shao-Ju Chang, Jenn-Chang Hwang, Chwung-Shan Kou, Kuen-Yi Wu, An-Ping Lee, Hsiao-Kuan Wei,"Plasma Device for Liquid Crystal Alignment", U. S. patent filed, January 17, 2007, Ref. No. 11/654,041.

12. Ru-Pin Chao (趙如蘋), Ci-Ling Pan (潘犀靈), and Chao-Yuan Chen (陳昭遠), "Tunable Terahertz Filter or Wavelength Selector Based on Magnetically Controlled Birefringence in Liquid Crystals," U. S. patent filed, February 2007, Ref. No. 11/606217.

13. Teh-Ho Tao（陶德和）, Tze-An Liu（劉子安）, Zu-sho Chow（周儒修）, Sheng-Lung Wu（吳勝隆）, Ci-Ling Pan（潘犀靈）, "皮膚灼傷檢測系統," Taiwan (ROC) patent, No. I276425, granted March 21, 2007.

14. Ru-Pin Chao（趙如蘋）, Hsin-Ying Wu（吳信穎）, "Tilted homeotropic and homogeneous alignments of liquid crystals employing magnetic thin films " approved by NCTU patent office for U. S. patent application, April 26, 2007.

15. Ci-Ling Pan（潘犀靈）, Ru-Pin Chao（趙如蘋）, and Chao-Yuan Chen（陳昭遠）, "Liquid-Crystal-Based Retardation-Free Terahertz Phase Shifter," US patents application published, No. US 2007/0188668 A1, Aug. 16, 2007.

16. 趙如蘋，吳信穎,「一種利用磁性薄膜對液晶分子進行有預傾角的水平及垂直配向之方法」ROC (Taiwan) patent filed, filing No.096135213, September 20, 2007.

17. Teh-Ho Tao（陶德和）, Tze-An Liu（劉子安）, Zu-sho Chow（周儒修）, Sheng-Lung Wu（吳勝隆）, Ci-Ling Pan（潘犀靈）, "System for Detecting the Burned Degree of a Skin," US patent 7307258 B2, December 11, 2007.

18. Ru-Pin Chao（趙如蘋）, Ci-Ling Pan（潘犀靈）, and Chao-Yuan Chen（陳昭遠）, "利用液晶雙折射現象之可調兆赫波濾鏡或波長選擇器," 中華民國專利公告 Taiwan (ROC) Patent disclosed, No. 200811486, 1 March, 2008, U. S. patent filed, February 2007, No. 11/606217.

B . Quantum (Photonic Crystal) structures and Enabling devices

1. S. C. Wang(王興宗), H. C. Kuo (郭浩中),G. S. Huang(黃根生)"_利用氮化鋁/氮化鎵超晶格成長無裂縫氮化鋁/氮化鎵的多層膜反射鏡"
2. 王興宗,郭浩中,黃根生,姚忻宏"Process for Fabricating Group III Nitride Based Reflectors"
3. 王興宗,郭浩中,黃根生,姚忻宏" III 族氮化物系反射鏡之製法"
4. Tien-Chang Lu （盧廷昌）, Chyong-Hua Chen （陳瓊華）,"以啁啾式週期模態延展層實現 L 型近場光型之高功率高效率半導體雷射,"(申請中)
5. Hung-Wen Huang（黃泓文）, Tien-Chang Lu（盧廷昌）, Ching-Hua Chiu（邱清華）, Hao-Chung Kuo（郭浩中）, Shing-Chung Wang（王興宗）," 利用光電化學氧化技術製作可電激發之奈米柱發光二極體" （校內已申請過）

3. List of Workshops/Conferences Hosted by the Project

1. Workshop On Global Perspectives In Frontiers Of Photonics: Computational Imaging, Biophotonics And Nanophotonics, May 18-19, 2005, Durham, USA.
2. Journey through Nanotechnology and Photonics（光電與奈米之旅）, NCTU, Hsinchu, Taiwan. a workshop designed to provide an overview for high school students, held on December 13, 2004 and December 16, 2005 and March 10, 2007 attended by ~ 500 10th and 11th grader from elite high schools.
3. Advanced Light Emitting Devices and Lasers, a workshop in honor of Prof. S. C. Wang, March 4, 2005.
4. Special Symposium on Liquid Crystal Science and Technologies, a workshop in Honor of Prof. Shu-Hsia Chen, April 15, 2005.
5. 光學發展的回顧和前瞻, April 29, 2005.
6. Mini-Workshop on Optical Information Processing in honor of Prof. Francis T. S. Yu Penn. State Univ., March 15-17, 2006
7. AP-THz 2006 (1st Asian-Pacific THz Photonics Workshop), Dec. 14, 2006, Hsinchu, Taiwan.
8. 建構兆位元紀元的光電科技, 2006 年研究成果發表會, March 17, 2007, NCTU, Hsinchu, Taiwan..
9. 2007 CSIC-NSC joint workshop on photonics, Nov. 5-6, 2007, NCTU, Hsinchu, Taiwan.
10. Photonic Science and Technology for the Tera-Era, 2008 Spring Workshop on X-Photonics, May 19-21, Hsinchu, Taiwan.

4. List of Personal Achievements of the PIs

I. Fauclty award and Recognitions

A. Coherent and THz Photonics

Prof. Ci-ling Pan:

1. 2004 OSA Fellows;
2. 2004 SPIE Fellow;
3. 2004 Engineering Medal 工程獎章 of the ROCOES 中華民國光學工程學會;
4. 2004 Outstanding Scholar Award of the Ministry of Education 教育部第 48 屆學術獎;
5. 2005 PSROC Fellow 中華民國物理學會會士;
6. 2006 Outstanding Engineering Professor Award, Chinese Institute of Engineers 中國工程師學會傑出工程教授獎
7. 2007 Research Excellence Award 研究傑出獎 of 潘文淵文教基金會 Pan Wen Yuen Foundation.

Prof. Gong-Ru Lin, 林恭如

1. 2005 NCTU Young Scholar Research Award 交大年輕學者研究獎
2. 2005 **年中國電機工程學會優秀青年工程師獎**
3. **2005 年第十九屆宏碁龍騰知識經濟論文優等獎**

4. 2008 SPIE Fellow

Prof. Chao-Kuei Lee 李晁逵

1. Young scientist traveling support Award. 2005 Advanced Solid-State Photonics Meeting, Vienna, Austria, Feb. 6-9, 2005

B. Quantum (Photonic Crystal) structures and Enabling devices

1. IEEE Life member (2006)
2. 潘文淵考察研究獎(2007)
3. 吳大猷先生研究紀念獎(2007)
4. 錸德青年獎章(2007)
5. 美國 IEEE and LEOS William Striefer 獎章遴選委員 2004

C. Volume Holographic Materials, Technology and Enabling devices

Prof. Ken Y. Hsu 許根玉

1. 2004 OSA Fellow

II. STUDENT AWARD AND RECOGNIZATION:

A. Coherent and THz Photonics

1. Sheng-Lung Wu (吳勝隆), Tze-An Liu, Zu-sho Chow, Jia-Huey Tsao, Teh-Ho Tao, and Ci-Ling Pan, “Burn-Depth Detection Of Pork With T-Ray Technology,” PF-SA2-02, presented at OPT2004, , Dec.18-19, 2004, Taipei, Taiwan, （2004 年台灣光電科技研討會壁報論文獎）.
2. Yu-Huang Lin and Gong-Ru Lin, “Reduction of Mode Beating Noise in Erbium-Doped Fiber Laser by Mutual Injection-Locking with a Laser Diode at below Threshold Condition”, IEEE Photonics Technology Letters, Vol. 16, No. 8, pp. 1819-1821, August 2004. (林鈺晃榮獲 2004 中華民國光學工程學會碩士論文獎).
3. Kuen-Chie Yo, Yung-Cheng Chang, and Gong-Ru Lin, “An OC-48 transmission based on a mutual injection-locked Fabry-Perot laser diode and Erbium doped fiber amplifier link,” Optics Express, submitted, July 2005. (游昆潔榮獲九十三年度國科會大專學生參與專題研究計畫研究創作獎)
4. Gong-Ru Lin, Yu-Huang Lin, and Yung-Cheng Chang, “Theory and Experiments of a Mode Beating Noise Suppressed and Mutually Injection-Locked Fabry-Perot Laser Diode and Erbium-Doped Fiber Amplifier Link,” IEEE Journal of Quantum Electronics, Vol. 40, No. 8, pp. 1014-1022, August 2004. (林鈺晃榮獲 2004 中國電機工程師學會青年論文獎)
5. Yung-Cheng Chang, Yu-Huang Lin, J. H. Chen, and Gong-Ru Lin, “All-optical NRZ-to-PRZ format transformer with an injection-locked Fabry-Perot laser diode at unlasing condition”, Optics Express, Vol. 12, No. 19, pp. 4449-4456, September 2004. (張詠誠榮獲財團法人徐有庠基金會第三屆通信光電類科

技論文獎 2005)

6. Ching-Wei Chen (陳晉瑋), Wen-Jr Jiang and Ci-Ling Pan, “Phase Retrieval Of Ultrafast Optical Pulses From Interferometric Autocorrelation Measurement By Population-Split Genetic Algorithm (PSGA)”, C-FR-V2-7, presented at OPT2005 (Optics and Photonics Taiwan), Dec. 9-10, 2005, Tainan, Taiwan.(2005 年光電科技研討會學生論文獎)
7. Ching-Wei Chen（陳晉瑋）, Yu-Kuei Hsu, J. Y. Huang, C. S. Chang, Ci-Ling Pan, Jing-Yuan Zhang, “Intense picosecond infrared pulses tunable from 2.4 m to 38 m for nonlinear optics applications”, paper # CFI3-1, IQEC/CLEO-PR 2005, Tokyo, Japan, July 11-15, 2005 (Student Travel Support Award).
8. 2005 年指導張峻源同學榮獲 2005 年光電科技研討會學生論文獎
9. 2006 年, 林螢聰同學獲得中國光學工程學會碩士論文獎.
10. 2006 年, 林螢聰同學獲得中國電機工程學會青年論文獎第二名.
11. 2006 年 廖育聖與游昆潔同學參加教育部通信競賽榮獲優等獎
12. Chao-Yuan Chen 陳昭遠, Recipient of The 2005 Bor-Uei Chen Memorial Scholarship Award of the Photonic Society of Chinese Americans (PSC，華人光電學會). This is the first time a Ph.D. student from outside of U.S. has been awarded this prestigious award.
13. Yu-Ping Lan 藍玉屏, Recipient of 九十四年優秀青年工程師獎, the 2006 Iizuka Prize for Young Metrologist, Asia Pacific Metrology Programme 亞太計量組織(http://www.apmpweb.org/)優秀青年計量學家獎, see news story in (http://140.113.100.134/news/news_detail.php?Cp=82&NID=9916).
14. C.W. Chen (陳晉瑋) and C.J. Hsu (許哲睿) and C.L. Pan (潘犀靈), “兆赫波於硒化鎵晶體中光參數放大之研究,” paper CO-001, Optics and Photonics in Taiwan, Nov. 30-Dec.1, 2007, Taichung, Taiwan. (Best Student Paper Award, OPT 2007, 2007 年光電科技研討會學生論文獎)
15. Y.T. Li (黎宇泰) and W.W. Wang (王韋文) and C.L. Pan (潘犀靈) and K.J. Chen (陳克堅) and J.T. Chen (陳錦泰), “低溫成長砷化鎵與多重氧離子佈植砷化鎵光導天線之 THZ 輻射特性之比較,” paper CO-004, ibid. (Best Student Paper Award, OPT 2007, 2007 年光電科技研討會學生論文獎)
16. Tsong-Ta Tang（湯宗達）, recipient of the 2007 NSC Graduate Student Study Abroad Program (GSSAP) Scholarship 國科會千里馬獎學金 for studying at University of California, Berkeley, California, USA for a year.
17. Cho-Fan Hsieh（謝卓凡）, recipient of the 2007 NSC Graduate Student Study Abroad Program (GSSAP) Scholarship 國科會千里馬獎學金 for studying at Osaka University, Osaka, Japan for 10 months.
18. Sung-Hui Lin (林松輝), Chao-Kuei Lee (李晁逵), Yi-Sheng Lin (林易聲), Shin-Cheng Liu (劉信成), and Ci-Ling Pan (潘犀靈), “A Study of Excitation Dynamics of Saturable Bragg Reflector: A Possible Alternative Approach for High Repetition Rate Mode-Locked Laser,” paper PE-29, 2008 中華民國物理學會年會及學術研討會 Annual Meeting of the Physical Society of Republic of China, Jan. 28-30, 2008, Hsinchu, Taiwan (Best Poster Paper Award, Honorable Mention 壁報論文佳作獎).
19. **2006** 年指導游昆潔同學獲得中國光學工程學會碩士論文獎
20. **2006** 年指導游昆潔同學獲得中國電機工程學會青年論文獎第一名

B. Quantum (Photonic Crystal) structures and Enabling devices

1. 指導劉子維同學榮獲 2007 年台灣光電科技研討會學生論文獎
2. 指導李昀恬同學榮獲 2007 年台灣光電科技研討會學生論文獎
3. 指導陳士偉同學榮獲 2007 年台灣光電科技研討會學生論文獎
4. 指導學生高志強榮獲中華民國光學工程學會最佳論文獎 2007
5. 指導學生林立凡榮獲第十二屆 科林論文獎 2007

6. 指導學生李亞儒榮獲教育部千里馬計畫補助出國研究一年 2006
7. 指導學生劉瑞農榮獲朱順一合勤學業優異獎學金 2006
8. 指導學生劉瑞農通過教育部公費留學考 2006
9. 指導學生柯宗憲榮獲第一屆國立交通大學奈米科技中心成果發表會暨奈米攝影競賽特優第一名 2006
10. 指導學生高宗鼎榮獲第十一屆 科林論文獎 2006
11. 指導學生林立凡榮獲 2006 年台灣光電科技研討會學生論文獎
12. 指導學生高宗鼎榮獲 2005 年台灣光電科技研討會學生論文獎
13. 指導學生曾國峰榮獲 2004 年台灣光電科技研討會學生論文獎
14. 指導學生賴芳儀榮獲 94 學年聯發科獎學金
15. 指導學生彭裕鈞榮獲 94 學年度朱順一合勤學業優異獎學金
16. 指導學生高宗鼎榮獲 95 學年光電工程學會碩士論文獎
17. 指導學生彭裕鈞榮獲 94 學年光電工程學會碩士論文獎

III. International Invited Papers and Presentations:

A. Coherent and THz Photonics

1. Gong-Ru Lin and Yu-Sheng Liao, “A Synchronous Modulation and Inter-Mixing Technique for Sensitivity and Error-Rate Analysis of Sonet PIN-TIA”, *2003 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2003)*, Session SC1, Wuhan, China, November 2-6, 2003.
2. Ci-Ling Pan, “NCTU Photonics Programs: an Overview,” invited talk, presented at the 2005 NRC-IME-ITRI Trilateral Photonics Workshop, Ottawa, Canada, Sept. 27-29, 2004.
3. Ci-Ling Pan, Ru-Pin Pan, Chao-Yuan Chen, T. R. Tsai, C. H. Wang, Cho-Fan Hsieh, “Liquid Crystal THz Optics,” invited talk, presented at the Croucher Advanced Study Institute on “Frontiers of Photonics Research: Nanophotonics, Femtosecond Photonics and Biophotonics,” Hong Kong, December 6-10, 2004.
4. Ci-Ling Pan, “Ultra-broadband THz field detection by Ion-implanted III-V PC Antenna,” invited talk, presented at the Photonics West 2005, San Jose, California, USA, Jan. 22-27, 2005.
5. Ci-Ling Pan, “An Overview of THz Research Activities in Taiwan,” invited talk, presented at the Photonics West 2005, San Jose, California, USA, Jan. 22-27, 2005.
6. Ci-Ling Pan, “Progress in Liquid Crystal THz Optics,” keynote speech, presented at Workshop On Global Perspectives In Frontiers Of Photonics: Computational Imaging, Biophotonics And Nanophotonics,” Durham, North Carolina, USA, May 18-19, 2005.
7. Ci-Ling Pan, “Recent Progress in Liquid Crystal THz Optics,” invited paper, presented at "Frontiers of Laser and Optical Sciences", October 1 - 2, 2005, Faculty of Science, Hongo Campus, The University of Tokyo, Tokyo, Japan.
8. Gong-Ru Lin, “Retrospect on the Research of Silicon Nanocrystal Embedded Silicon Oxide Materials and Light-Emitting Devices in NCTU/IEO”, ***3rd Symposium on Nanophotonics Science and Technology***, Hwalian, Taiwan, September 13-17, 2005
9. Gong-Ru Lin, “All-Optical NRZ-to-RZ Data Format Conversion with Optically Injected Laser Diodes orSemiconductor Optical Amplifiers”, *2006 Asia-Pacific Optical and Wireless Communications Conference and Exhibition (APOC 2006)*, Invited paper, Gwangju Korea, September 3-7, 2006.

10. Ci-Lin Pan and Ru-Pin Pan, "Recent progress in liquid crystal THz optics," invited talk, presented at Photonics West 2006, San Jose, California, USA, Jan. 21-26, 2006, invited paper to be published in Proceedings of SPIE Vol. #6135, Liquid Crystal Materials, Devices, And Applications XI, Liang-Chy Chien, ed..
11. Ci-Lin Pan and Ru-Pin Pan, "Recent progress in liquid crystal THz optics," **invited talk**, presented at Photonics West 2006, San Jose, California, USA, Jan. 21-26, 2006, invited paper, in Proceedings of SPIE -- Volume 6135 Liquid Crystal Materials, Devices, and Applications XI, Liang-Chy Chien, Editor, pp. 61350D-1 to -13 (Feb. 23, 2006).
12. Ci-Ling Pan, "An Overview of NCTU Photonics Programs and Selected THz Topics," **invited talk**, presented at the NSC-UPM Workshop On Optoelectronics, Sala De Juntas, Edificio A, Etsi Telecomunicacion, Universidad Politechnica Madrid, Madrid, Spain, May 22, 2006.
13. Ci-Ling Pan, "Nonlinear optical studies of Si-O polar nanostructures," **invited talk**, presented at the 13th Laser Physics Workshop, Zhang Jia Jie, China, Oct. 20-25, 2006.
14. Ru-Pin Pan, and Ci-Ling Pan, "Control of enhanced THz transmission through metallic hole arrays using liquid crystals", **invited talk,** presented at the 13th laser physics workshop, Changziajie, Sanxi, China, 20-25, October, 2006,
15. Shiuan-Huei Lin and Ken Y. Hsu, "Holographic memory and applications using doped photopolymer", (**invited talk**) 5th International Conference on Optics-Photonics Design & Fabrication, Nara, Japan, December 6-8, 2006.
16. Gong-Ru Lin, "Nanocrystallite Si Photonics", ***2006 First NTU-LAAS Joint Workshop on Micro/Nano Systems (NTU-LAAS WMNS 2006)***, Invited talk, Taipei, Taiwan, Nov. 13,2006.
17. Gong-Ru Lin, "White-light and near-infrared electroluminescence of furnace or CO2 laser annealed Si-rich SiO2 with structural defects and Si nanocrystals", *2006 SPIE Symposium on Photonics Europe (PE 2006)*, paper 6195-32, Strasbourg, France, April 3-6, 2006.
18. Ru-Pin Pan and Ci-Ling Pan, "Liquid-Crystal-based Electrically Tunable THz Optical devices," invited talk, presented at Photonics West 2007, San Jose, California, USA, Jan. 20-35, 2007, invited paper published in Proceedings of SPIE -- Volume 6487 Emerging Liquid Crystal Technologies II, Liang-Chy Chien, Editors, item 648709 (Feb. 9, 2007).
19. Ci-Ling Pan, "THz Photonic Elements with Liquid-Crystal-Enabled Functionalities," invited talk, presented at the SURA THz Applications Workshop, Washington, D. C., June 6 – 8, 2007.
20. Ci-Ling Pan, "Overview of NCTU Photonics Programs and Selected Topics in Laser Technology and Optics of Structured Materials," invited talk, presented at the 2nd Cross-Strait Workshop on Optical Microstructures and Laser Technology, Nanjing, China, Sept. 11 – 16, 2007.
21. Ci-Ling Pan, Hyeyoung Ahn, Chun-Hao Chuang and Yi-Chao Wang, "Optical-Pump-THz-Probe studies of femtosecond-laser annealed amorphous silicon," invited talk, presented in Terahertz Photonics, Conference PA120, SPIE Photonics Asia Conferences, also the 2nd Asian-Pacific Workshop on THz Photonics (AP-THz2007), 11 - 15 November 2007Beijing International Convention Centre, Beijing China.
22. Gong-Ru Lin, "Semiconductor Laser and Amplifier Based 10 Gbit/s All Optical NRZ-to-RZ Data FormatConverter", *2007 Symposium on Electro-Optical Engineering*, Invited talk, National Taipei University ofTechnology, Taipei, Taiwan, July 6, 2007.
23. Gong-Ru Lin and Chun-Jung Lin, "Silicon Nanocrystal Based MOSLED on Silicon Nanopillar Array", *7thIEEE International Conference on Nanotechnology (IEEE-NANO2007)*, invited paper, Hong Kong,China,

Aug. 2-5, 2007.

24. Gong-Ru Lin, "Enhanced Electroluminescence from Nanocrystallite Si Based MOSLED by Interfacial Si Nanopyramids", *OSA Topical Conference on Nanophotonics (NANO2007)*, Hangzhou, China, June 18-21,2007.
25. Gong-Ru Lin, "All-Optical 10Gbit/s Data Format Conversion in Temporally Gain Shaped SemiconductorOptical Amplifier Based", *2007 Symposium on Next-Generation Lightwave Communications*, Invited talk, Chinese University of Hong Kong (CUHK), Hong Kong, June 11-13, 2007.
26. Gong-Ru Lin, "All-in-one Amplified Compressor for Sub-50fs Soliton Generation from Mode-Locked FiberLasers", *2007 Asia-Pacific Microwave Photonics Conference (AP-MWP 2007)*, Jeju Island, Korea, April 25-27, 2007
27. Gong-Ru Lin, "Nanocrystallite Si Based MOS light Emitting Diodes", *4th U.S. Air Force-Taiwan Nanoscience Initiative Workshop* , Invited Talk, Houston TX, USA, February 8-9, 2007.
28. Ci-Ling Pan, Ru-Pin Pan, I-Chen Ho, Cho-Fan Hsieh and Chao-Yuan Chen, "Birefrient Terahertz filters using nematic liquid crystals," invited talk, presented at Photonics West 2008, San Jose, California, USA.
29. Ru-Pin Pan, Hsin-Ying Wu, and Cho-Fan Hsieh "Liquid crystal surface alignments by using films composed of magnetic nanoparticles" ,invited talk, presented at Photonics West 2008 , Jan 19-24, 2008, San Jose, California, USA.

B. Quantum (Photonic Crystal) structures and Enabling devices

1. S.C.Wang, invited talk, 2004 US Airforce & Taiwan Nanoscience Initiative Workshop, "Fabrication and emission characteristics of p-GaN and GaN multiple quantum well nanorods" 2004.
2. T. C. Lu ,H. C. Kuo, S.C.Wang, invited talk, 2006 US Airforce & Taiwan Nanoscience Initiative Workshop, "Nano-fabrication technigue in GaN-based devices" 2006.
3. H. H. Yao, G. S. Huang, T.C. Lu, H. C. Kuo and S. C. Wang, invited talk "Effects of growth interruption time on InGaN/GaN quantum dots size grown by metal organic chemical vapor deposition", in Gallium Nitride materials and devices, Vol 6121, part of SPIE's Integrated Optoelectronics Devices, 2006 San Jose, CA, USA
4. Hao-chung Kuo *et al.* "Dynamic Characteristics of InAs/GaAs Quantum Dot VCSELs grown by MBE" invited speaker MBE Taiwan 2006 & High-k Materials Workshop
5. Tien-chang Lu, C. C. Kao, G. S. Huang, H. C. Kuo, and S. C. Wang "Recent progress on GaN-based vertical cavity surface emitting lasers," *Invited talk*, 6766-15, SPIE Optics East, Seaport World Trade Center, Boston, Massachusetts USA, Sept. 9-12, 2007
6. Tien-chang Lu, C. C. Kao, G. S. Huang, H. C. Kuo, and S. C. Wang "Optically and Electrically Pumped GaN-based VCSELs," *Invited talk*, WA2-1, The 7th Pacific Rim Conference on Lasers and Electro-Optics (CLEO/PR 2007), COEX, Seoul, Korea Aug. 26-31, 2007

C. Volume Holographic Materials, Technology and Enabling devices

1. Ken Y. Hsu, Shiuan-Huei Lin, Yi-Nan Hsiao, and Po-Lin Chen, "Fabrication and Characterization of poly (methyl methacrylate) photopolymer doped with quinone-based photosensitive molecules for volume holographic recording," (invited talk) Paper ThH1-1, The 7th Pacific Rim Conference on Lasers and Electro-Optics, Seoul, Korea, August 26 - 31, 2007.
2. Shiuan-Huei Lin and Ken Y. Hsu," Low-Shrinkage Doped PMMA Photopolymer for Holographic Data

Storage Applications", (invited talk), conference proceeding, p. 86, 6th International Syposium on Modern Optics and its applications, Bandung, August, 6-10, 2007.

IV. Editorial Activities

1. Ken Yuh Hsu（許根玉）, Editor, Optical Memory & Neural Network (Information Optics).
2. Ken Yuh Hsu（許根玉）, Advisory Editor, Optics Letters (2002-2006).
3. Ci-Ling Pan (潘犀靈), Member, Advisory Editorial Board, Asia Materials, Part of Nature Asia-Pacific, 2008 -
4. Proceeding guest editor, 2005 IEEE International Microwave Photonics, (Hao-chung Kuo 郭浩中)

V. International Committee Activities:

1. Ci-Ling Pan (潘犀靈), Chair, 2009 Charles Townes Award Committee, OSA.
2. Ci-Ling Pan (潘犀靈),Member, Program Committee, Emerging Liquid Crystal Technologies IV (OE26), Part of the SPIE International Symposium on Integrated Optoelectronic Devices 2009, Photonics West 2009 (SPIE), San Jose, California, USA.
3. Ci-Ling Pan (潘犀靈), Member, the Member & Education Services Council, OSA January 1, 2007 to December 31, 2009.
4. Ci-Ling Pan (潘犀靈), Member, Program Committee, Emerging Liquid Crystal Technologies III, Photonics West 2008 (SPIE), San Jose, California, USA.
5. Ci-Ling Pan (潘犀靈), Member, 2008 Charles Townes Award Committee, OSA.
6. Ci-Ling Pan (潘犀靈), Member, Organizing Committee, 6th International Conference on Optics-Photonics Design and Fabrication, 2008 (ODF'08), June 9-11, 2008, Taipei, Taiwan.
7. Ci-Ling Pan (潘犀靈), Co-chair, the program sub-committee on THz Waves in Biophotonics, the 10th International Conference on Laser Applications in Life Sciences (LALS), December 04 through 06, 2008, Taipei, Taiwan.
8. Ci-Ling Pan (潘犀靈), Member, Technical Program Committee, Emerging Liquid Crystal Technologies II, Photonics West 2007 (SPIE), January 20-25, 2007, San Jose, California, USA.
9. Ci-Ling Pan (潘犀靈), Member, Technical Program Committee, 2007 Asia-Pacific Microwave Photonics Conference (AP-MWP 2007), April 25 - 27, 2007, Jeju Island, Korea.
10. Ci-Ling Pan (潘犀靈), Member, Program Committee, Terahertz Photonics, Conference PA120, SPIE Photonics Asia Conferences, also the 2nd Asian-Pacific Workshop on THz Photonics (AP-THz2007), 11 - 15 November 2007Beijing International Convention Centre, Beijing China.
11. Ci-Ling Pan (潘犀靈), Member, Local Program Comm., The 9th International Conference on Optics Within Life Sciences (OWLS9), Nov. 26-29, 2006, Taipei.
12. Ci-Ling Pan (潘犀靈), Member, International Advisory Comm., International Forum on Systems and Mechatronics, 2006, December 6-8, 2006, NCKU, Tainan, Taiwan.
13. Ci-Ling Pan (潘犀靈), Chair, 1st Asian-Pacific Workshop on THz Photonics, to be held on Dec. 14, 2006, NCTU Campus, Hsinchu, Taiwan.
14. Ci-Ling Pan (潘犀靈), Member, Technical Program Committee, Emerging Liquid Crystal Technologies II, Photonics West 2007 (SPIE), San Jose, California, USA.
15. Ci-Ling Pan (潘犀靈), Member, Technical Program Committee, 2007Asia-Pacific Microwave Photonics Conference (AP-MWP 2007), April 25 - 27, 2007, Jeju Island, Korea.
16. Gong-Ru Lu (林恭如), 2006 Asia-Pacific THz Photonics Workshop (AP-2006) Local Organizing Committee Member

17. Gong-Ru Lu (林恭如), 2006 First NTU-LAAS Joint Workshop on Micro/Nano Systems (NTU-LAAS-2006) TPC Co-Chair
18. Gong-Ru Lu (林恭如), 2006 Vice Chair of the International Society for Optical Engineering (SPIE), Taiwan Chapter
19. Gong-Ru Lu (林恭如), 2006 Advisor of the SPIE Student Chapter of National Chiao Tung University.
20. S. C. Wang, Member, Technical Program Committee, Micooptics Conference (MOC), Kagawa, Japan.
21. S C Wang, Member, Technical Program Committee, The 7th Pacific Rim Conference on Lasers and Electro-Optics (CLEO-PR 2007)
22. S C Wang, Member, Technical Program Committee and short course, Photonics West 2007 (SPIE), San Jose, California, USA.
23. H. C. Kuo, Member, Technical Program Committee, 2007Asia-Pacific Microwave Photonics Conference (AP-MWP 2007), April 25 - 27, 2007, Jeju Island, Korea.
24. H. C. Kuo, Member, Technical Program Committee, 212th Electrochemical Society Meeting, Washington, DC, Oct. 7-12, 2007
25. Ken Yuh Hsu（許根玉）, Program Committee, The 7th Pacific Rim Conference on Lasers and Electro-Optics, Seoul, Korea, August 26 - 31, 2007.
26. Ken Yuh Hsu（許根玉）, Program Committee, Symposium on Photorefractives XI, SPIEs 52th Annual Meeting, San Diego, USA, August, 2007.
27. Shiuan Huei Lin（林烜輝）, Program Committee, 6th International Conference on Optics-Photonics Design & Fabrication, June, 2008

5. List of Technology Transfers

1. Technology transfer to CMC corp. for NT$ 1,000,000, “Fabrication on PQ:PMMA Holographic disk”.
2. GOC 全球光通: Tapped Fiber Splicing Process for Reduction Splicing Loss between Single-Mode & Erbium-Doped Fibers
3. 聖威光電: Sensitive Evaluation of Fiber-Optic SONET OC-48 PIN-TIA Receivers Using Sweep-Frequency Modulation and Inter-Mixing Diagnostics

6. List of Technology Services

7. Papers selected by AIP Virtural Journals

1. Sub femto-joule sensitive single-shot OPA-XFROG and its application in study of white-light supercontinuum generation
Jing-Yuang Zhang, Chao-Kuei Lee, Jung Y. Huang and Ci-Ling Pan
Optics Express., Vol. 12, No. 4, pp. 574-581, February 23, 2004
Virtual Journal of Ultrafast Science, April 2004

2. Magnetically Tunable Room-Temperature 2p Liquid Crystal Terahertz Phase Shifter Chao-Yuan Chen, Cho-Fan Hsieh, Yea-Feng Lin, Ru-Pin Pan, and Ci-Ling Pan
Opt. Express, Vol. 12, No. 12, pp. 2625-2630, June 14, 2004
Virtual Journal of Ultrafast Science, September 2004

3. Ultrabroadband terahertz field detection by photoconductive antennas based on proton-bombarded InP
Tze-An Liu, Masahiko Tani, Makoto Nakajima, Masanori Hangyo, Kiyomi Sakai, Shin-ichi Nakashima, and Ci-Ling Pan
Opt. Express, Vol. 12, No.13, pp. 2954-2959, June 28, 2004
Virtual Journal of Ultrafast Science, August 2004

4. Near-Infrared Femtosecond Laser-induced Crystallization of Amorphous Silicon
Jia-Min Shieh, Zun-Hao Chen, Bau-Tong Dai, Yi-Chao Wang, Alexei Zaitsev, and Ci-Ling Pan

Appl. Phys. Lett., Vol. 85, Issue 7, pp. 1232-1234, August 16, 2004
Virtual Journal of Ultrafast Science, September 2004

5. Theoretical and Experimental Studies of tunable UV/Blue Femtosecond Pulses in a 405nm-pumped Type-I b-BBO Non-collinear Optical Parametric Amplifier
Chao-Kuei Lee, Jin-Yuan Zhang, J. Y. Huang and Ci-Ling Pan
J. Opt. Soc. Am. B, Vol. 21, Issue 8, pp. 1494-1499, August 2004
Virtual Journal of Ultrafast Science, Vol. 3, No. 9, September 2004

6. Freezing phase scheme for fast adaptive control and its application to characterization of femtosecond coherent optical pulses reflected from semiconductor saturable absorber mirrors
Ming C. Chen, Jung Y. Huang, Qiantso Yang, C. L. Pan, and Jen-Inn Chyi
Journal of the Optical Society of America B, Vol. 22, No. 5, pp. 1134-1142, May 2005
Virtual Journal of Ultrafast Science, Vol. 4, No. 6, June 2005

7. Multi-Energy Arsenic-Ion-Implanted GaAs Photoconductive THz Spiral Antenna with Suppressed Dark Current and Trailing Edge
Tze-An Liu, Gong-Ru Lin, Yen-Chi Lee, Shing-Chung Wang, M. Tani, Hsiao-Hua Wu, and Ci-Ling Pan
J. Appl. Phys., Vol. 98, 013711-1 to -4, July 15, 2005
Virtual Journal of Ultrafast Science, Vol. 4, No. 8, August 2005

8. Time-Resolved Photoluminescence Analysis of Multidose Si-Ion-Implanted SiO_2
Chun-Jung Lin, Chao-Kuei Lee, Eric Wei-Guang Diau, and Gong-Ru Lin
J. Electrochem. Soc. 153, E25-E32, (2006)
Virtual Journal of Ultrafast Science, Vol. 5, No. 1, January 2006

9. Path-dependent human identification using a pyroelectric infrared sensor and fresnel lens arrays
Jian-Shuen Fang, Qi Hao, David J. Brady, Mohan Shankar, Bob D. Guenther, Nikos P. Pitsianis, Ken Y. Hsu
Optics Express, Vol. 14, Issue 2, pp. 609-624, January 2006
Virtual Journal of Biomedical Optics, Vol. 1, No. 2, Feb.10, 2006

10. Path-dependent human identification using a pyroelectric infrared sensor and Fresnel lens arrays,
Jian-Shuen Fang, Qi Hao, David J. Brady, Mohan Shankar, Bob D. Guenther, Nikos P. Pitsianis, and Ken Y. Hsu,
Optics Express Vol. 14, 609-624, 2006.
Virtual J. for Biomedical Optics, Vol. 1, Issue2, Feb. 10, 2006.

11. A Liquid-Crystal-Based Terahertz Tunable Lyot Filter
Chao-Yuan Chen, Cho-Fan Hsieh, Yea-Feng Lin, Ci-Ling Pan and Ru-Pin Pan
Appl. Phys. Lett., Vol. 88, 101107, March 6, 2006
Virtual Journal of THz Science and Technology, March 2006

12. Supermode-noise-free eighth-order femtosecond soliton from a backward dark-optical-comb-injection mode-locked semiconductor optical amplifier fiber laser
Gong-Ru Lin, Ci-Ling Pan, and I-Hsiang Chiu
Opt. Lett. Vol. 31, No. 6, pp. 835-837, March 15, 2006
Virtual Journal of Ultrafast Science, Vol. 5, No. 6, June 2006

13. Dopant Profile Engineering by Near-Infrared Femtosecond Laser Activation
Yi-Chao Wang, Ci-Ling Pan, Jia-Min Shieh and Bau-Tong Dai
Appl. Phys. Lett., Vol. 88, 1311104, March 27, 2006

Virtual Journal of Nanoscale Science and Technology, Vol. 13, No. 14, April 10, 2006
Virtual Journal of Ultrafast Science, Vol. 5, No. 4, April 2006

14. Dynamic characteristics of long-wavelength quantum dot vertical-cavity surface-emitting lasers with light injection
P. C. Peng, H. C. Kuo, W. K. Tsai, Y. H. Chang, C. T. Lin, S. Chi, S. C. Wang, G. Lin, H. P. Yang, K. F. Lin, H. C. Yu, and J. Y. Chi
Opt. Express 14, 2944-2949, April 3, 2006
Virtual Journal of Nanoscale Science and Technology, Vol. 13, No. 20, May 22, 2006

15. Voltage-controlled liquid crystal terahertz phase shifter and quarter wave plate
Cho-Fan Hsieh and Ru-Pin Pan, Tsung-Ta Tang, Hung-Lung Chen, and Ci-Ling Pan
Optics Letters, Vol. 31, No. 8, pp. 1112-1114, April 15, 2006
Virtual Journal of THz Science and Technology, April 2006
OSA Virtual Journal for Biomedical Optics, Vol. 1, No. 5, May 2006

16. Fabrication of magnesium-doped gallium nitride nanorods and microphotoluminescence characteristics
Fang-I Lai, S. Y. Kuo, Y. H. Chang, H. W. Huang, C. W. Chang, C. C. Yu, C. F. Lin, H. C. Kuo, and S. C. Wang
J. Vac. Sci. Technol. B 24, 1123-1126, May 2006
Virtual Journal of Nanoscale Science and Technology, Vol. 13, No. 17, May 1, 2006

17. All-optical pulse data generation in a semiconductor optical amplifier gain-controlled by a reshaped optical clock injection,
Gong-Ru Lin, Kun-Chieh Yu, Yung-Cheng Chang,
Applied Physics Letters, Vol. 88, No. 19, 191114, May 2006.
Virtual Journal of Ultrafast Science, Vol. 5, No. 6, June 2006.

18. Dual-Stage Soliton Compression of a Self-Started Additive Pulse Mode-Locked Erbium-Dope Fiber Laser for 48-fs Pulse Generation,
Ying-Tsung Lin and Gong-Ru Lin,
Optics Letters, Vol. 31, No. 10, pp. 1382-1384, May 2006.
Virtual Journal of Ultrafast Science, Vol. 5, No. 7, June 2006.

19. 10 Gbit/s All-Optical NRZ-to-RZ Data Format Conversion Based on a Backward Dark-Optical-Comb Injected Semiconductor Optical Amplifier
Gong-Ru Lin, Kun-Chieh Yu, and Yung-Cheng Chang,
Optics Letters, Vol. 31, No. 10, pp. 1376-1378, May 2006
Virtual Journal of Ultrafast Science, Vol. 5, No. 7, June 2006

20. Trap-state density in continuous-wave laser-crystallized single-grain-like silicon transistors
Yu-Ting Lin and Chih Chen, Jia-Min Shieh and Yao-Jen Lee, Ci-Ling Pan, Ching-Wei Cheng, Jian-Ten Peng, and Chih-Wei Chao
Appl. Phys. Lett., 88, 233511, June 5, 2006
Virtual Journal of Nanoscale Science and Technology, Vol. 13, No. 24, June 19, 2006

21. Erbium doped GaSe crystal for mid-IR applications
Yu-Kuei Hsu, Ching-Wei Chen, Jung Y. Huang, Ci-Ling Pan, Jing-Yuan Zhang, Chen-Shiung Chang
Optics Express, Vol. 14, No. 12, pp. 5484-5491, June 12, 2006
Virtual Journal of Ultrafast Science, Vol. 5, No. 8, August 2006
OSA Virtual Journal for Biomedical Optics, Vol. 1, No. 7, July 2006

22. Observation of strong red photoluminescence with broadband in indium oxynitride nanoparticles

T. S. Ko, C. P. Chu, H. G. Chen, T. C. Lu, H. C. Kuo, and S. C. Wang
J. Vac. Sci. Technol. A 24, 1332-1335, July 2006
Virtual Journal of Nanoscale Science and Technology, Vol. 14, No. 1, July 4, 2006

23. Electrically Tunable Room-Temperature 2π Liquid Crystal Terahertz Phase Shifter
Hsin-Ying Wu, Cho-Fan Hsieh, Tsung-Ta Tang, Ru-Pin Pan, and Ci-Ling Pan
IEEE Photon. Technol. Lett., Vol. 18, No. 14, pp. 1488-1490, July 15, 2006
Virtual Journal of THz Science and Technology, July 2006

24. Fabrication and photoluminescence of InGaN-based nanorods fabricated by plasma etching with nanoscale nickel metal islands
H. W. Huang, J. T. Chu, T. H. Hsueh, M. C. Ou-Yang, H. C. Kuo, and S. C. Wang
J. Vac. Sci. Technol. B 24, 1909-1912, July 2006
Virtual Journal of Nanoscale Science and Technology, Vol. 14 No. 4, July 24, 2006

25. Real-time human identification using a pyroelectric infrared detector array and hidden Markov models
Jian-Shuen Fang, Qi Hao, David J. Brady, Bob D. Guenther, Ken Y. Hsu
Optics Express, Vol. 14, Issue 15, pp. 6643-6658, July 2006
Virtual Journal of Biomedical Optics, Vol. 1, No. 8, August 7, 2006

26. Rapid Self-Assembly of Ni Nanodots on Si Substrate covered by a Less-Adhesive and Heat-Accumulated SiO2 Layer,
Gong-Ru Lin, Hao-Chung Kuo, Huang-Shen Lin, and Chi-Chiang kao,
Applied Physics Letters, Vol. 89, No. 7, pp. 073108, August 2006.
Virtual Journal of Nanoscale Science & Technology, Vol. 14, No. 9, August 2006.

27. Tunable optical group delay in quantum dot vertical-cavity surface-emitting laser at 10 GHz
P.C. Peng, C.T. Lin, H.C. Kuo, G. Lin, W.K. Tsai, H.P. Yang, K.F. Lin, J.Y. Chi, S. Chi, and S.C. Wang
Electron. Lett. 42, 1036-1037, August 31, 2006
Virtual Journal of Nanoscale Science and Technology, Vol. 14, No. 11, Sep. 11, 2006

28. Synthesis of Si Nano-Pyramids at SiOx/Si Interface for Enhancing Electroluminescence of Si-Rich SiOx Based MOS Diode,
Gong-Ru Lin, Chi-Kuan Lin, L.-J. Chou, and Y.-L. Chueh,
Applied Physics Letters, Vol. 89, No. 9, 093126, September 2006.
Virtual Journal of Nanoscale Science & Technology, Vol. 14, No. 12, September 2006.

29. Generation Properties of Coherent Infrared Radiation in the Optical Absorption Region of GaSe
Ching-Wei Chen, Yu-Kuei Hsu, Jung Y. Huang, and Chen-Shiung Chang, Jing-Yuan Zhang, Ci-Ling Pan
Optics Express, Vol. 14, Issue 22, pp. 10636-10644, Oct. 30, 2006
Virtual Journal of Ultrafast Science, Vol. 6, No. 1, January 2007
Virtual Journal of THz Science and Technology, October 2006

30. Pulse retrieval from interferometric autocorrelation measurement by use of the population-split genetic algorithm
Ching-Wei Chen, Jung Y. Huang and Ci-Ling Pan
Optics Express, Vol. 14, No. 22, pp. 10930-10938, Oct. 30, 2006
Virtual Journal of Ultrafast Science, Vol. 6, No. 1, January 2007

31. InGaN/GaN nanostripe grown on pattern sapphire by metal organic chemical vapor deposition
T. S. Ko, T. C. Wang, R. C. Gao, Y. J. Lee, T. C. Lu, H. C. Kuo, S. C. Wang, and H. G. Chen
Appl. Phys. Lett. 90, pp. 013110, January 4, 2007

Virtual Journal of Nanoscale Science and Technology, Vol. 15, No. 3, January 22, 2007

32. Enhanced photoresponse of a Metal-Oxide-Semiconductor photodetector with Si nanocrystals embedded in the oxide layer
Jia-Min Shieh, Yi-Fan Lai, and Wei-Xin Ni, Hao-Chung Kuo, Chih-Yao Fang, Jung Y. Huang, and Ci-Ling Pan
Appl. Phys. Lett., Vol. 90, art. 051105, January 30, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 15, No. 6, February 12, 2007

33. A pyroelectric infrared biometric system for real-time walker recognition by use of a maximum likelihood principal components estimation (MLPCE) method
Jian-Shuen Fang, Qi Hao, David J. Brady, Bob D. Guenther, Ken Y. Hsu
Optics Express, Vol. 15, Issue 6, pp. 3271-3284, March, 2007
Virtual Journal of Biomedical Optics, Vol. 2, No. 4, April 10, 2007

34. Anomalous microphotoluminescence of high-aspect-ratio Si nanopillars formatted by dry-etching Si substrate with self-aggregated Ni nanodot mask
Gong-Ru Lin, Chun-Jung Lin, Hao-Chung Kuo, Huang-Sheng Lin, and Chi-Chiang Kao
Appl. Phys. Lett. 90, 143102, April 2, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 15, No. 15, April 16, 2007

35. High quality factor microcavity lasers realized by circular photonic crystal with isotropic photonic band gap effect
Po-Tsung Lee, Tsan-Wen Lu, Jyun-Hao Fan, and Feng-Mao Tsai
Appl. Phys. Lett. 90, 151125, April 13, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 15, No. 17, April 30, 2007

36. Optical properties of InGaN quantum dots grown by SiN_x nanomasks
L. L. Huang, H. J. Chang, Y. Y. Chou, C. H. Wang, T. T. Chen, Y. F. Chen, J. Y. Tsai, S. C. Wang, and H. C. Kuo
J. Appl. Phys. 101, 083501, April 16, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 15, No. 17, April 30, 2007

37. Investigation on spectral loss characteristics of subwavelength terahertz fibers
Hung-Wen Chen, Yu-Tai Li,Ci-Ling Pan, Jeng-Liang Kuo, Ja-Yu Lu, Li-Jin Chen, and Chi-Kuang Sun
Opt. Lett. Vol. 32, No. 9, pp. 1017-1019, May 1, 2007
Virtual Journal of THz Science and Technology, May 2007

38. Low refractive index Si nanopillars on Si substrate
Gong-Ru Lin, Ya-Chung Chang, En-Shao Liu, Hao-Chung Kuo, and Huang-Shen Lin
Appl. Phys. Lett. 90, 181923, May 3, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 15, No. 19, May 14, 2007

39. Optical characteristics of *a*-plane InGaN/GaN multiple quantum wells with different well widths
T. S. Ko, T. C. Lu, T. C. Wang, M. H. Lo, J. R. Chen, R. C. Gao, H. C. Kuo, S. C. Wang, and J. L. Shen
Appl. Phys. Lett. 90, 181122, May 3, 2007
Virtual Journal of Ultrafast Science, Vol. 6, No. 6, June 2007

40. Near-infrared femtosecond laser crystallized poly-Si thin film transistors
Yi-Chao Wang, Jia-Min Shieh, Hsiao-Wen Zan and Ci-Ling Pan
Opt. Exp., Vol. 15, No. 11, pp. 6981-6986, May 28, 2007
Virtual Journal of Ultrafast Sciences, Vol . 6, No. 7, July 2007

41. Synthesis of In_2O_3 nanocrystal chains and annealing effect on their optical properties
T. S. Ko, C. P. Chu, J. R. Chen, Y. A. Chang, T. C. Lu, H. C. Kuo, and S. C. Wang
J. Vac. Sci. Technol. A 25, 1038, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 16, No. 3, July 16, 2007

42. Highly Strained InGaAs/GaAs Quantum Well Vertical-Cavity Surface-Emitting Lasers
Hung-Pin D. Yang, I-Liang Chen, Chen-Hong Lee, Chih-Hong Chiou, Tsin-Dong Lee, I-Chen Hsu, Fang-I Lai, Gray Lin, Hao-Chung Kuo, and Jim Y. Chi
Jpn. J. Appl. Phys., Part 2 46, L509-L511, June 25, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 16, No. 3, July 16, 2007

43. Sub- THz Photonic- Transmitters Based on Separated- Transport- Recombination Photodiode and Micromachined Slots Antenna
Yu-Tai Li, J.-W. Shi, Ci-Ling Pan, C.-H. Chiu, W.- S. Liu, C. -K. Sun, and J. -I. Chyi
IEEE Photon. Technol. Lett., Vol. 19, No. 11 pp. 840-842, June 1, 2007
Virtual Journal of THz Science and Technology, June 2007

44. All-Optical Decision-Gating of 10-Gb/s RZ Data in a Semiconductor Optical Amplifier Temporally Gain-Shaped With Dark-Optical-Comb
Gong-Ru Lin, Kun-Chieh Yu, Ci-Ling Pan and Yu-Sheng Liao
Journal of Lightwave Technology, Vol. 25, No. 7, pp. 1651 – 1658, July 2007
Virtual Journal of Ultrafast Science Vol. 6, No. 12, December 2007

45. Lasing characteristics of a GaN photonic crystal nanocavity light source
Chun-Feng Lai, Peichen Yu, Te-Chung Wang, Hao-Chung Kuo, Tien-Chang Lu, Shing-Chung Wang, and Chao-Kuei Lee
Appl. Phys. Lett. 91, 041101, July 23, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 16, No. 6, August 6, 2007

46. Improving carrier transport and light emission in a silicon-nanocrystal based MOS light-emitting diode on silicon nanopillar array
Gong-Ru Lin, Chun-Jung Lin, and Hao-Chung Kuo
Appl. Phys. Lett. 91, 093122, August 29, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 16, No. 11, Sep. 10, 2007

47. Anisotropy of light extraction from two-dimensional photonic crystal light-emitting diodes
Chun-Feng Lai, H. C. Kuo, C. H. Chao, H. T. Hsueh, J.-F. T. Wang, W. Y. Yeh, and J. Y. Chi
Appl. Phys. Lett. 91, 123117, Sep. 29, 2007
Virtual Journal of Nanoscale Science and Technology, Vol. 16, No. 14, October 1, 2007

48. Terahertz emission from vertically aligned InN nanorod arrays
H. Ahn, Y.-P. Ku, Y.-C. Wang, C.-H. Chuang, S. Gwo, and Ci-Ling Pan
Appl. Phys. Lett. 91 (13), 132108, Sep. 27, 2007
Virtual Journal of THz Science and Technology, September 2007

49. Dynamic chirp control of all-optical format-converted pulsed data from a multi-wavelength inverse-optical-comb injected semiconductor optical amplifier
Gong-Ru Lin, Ci-Ling Pan and Kun-Chieh Yu
Opt. Exp., Vol. 15, Issue 20, pp. 13330-13339, October 1, 2007
Virtual Journal of Ultrafast Science, Vol. 6, No. 12, December 2007

50. Terahertz spectroscopic study of vertically aligned InN nanorods

H. Ahn, Y.-P. Ku, Y.-C. Wang, C.-H. Chuang, S. Gwo, and Ci-Ling Pan
Appl. Phys. Lett. 91 (16), 163105, October 16, 2007
Virtual Journal of THz Science and Technology, October 2007

51. GaN-based two-dimensional surface-emitting photonic crystal lasers with AlN/GaN distributed Bragg reflector
Tien-Chang Lu, Shih-Wei Chen, Li-Fan Lin, Tsung-Ting Kao, Chih-Chiang Kao, Peichen Yu, Hao-Chung Kuo, Shing-Chung Wang, and Shanhui Fan
Appl. Phys. Lett. 92, 011129, January 11, 2008
Virtual Journal of Nanoscale Science and Technology, Vol. 17, Iss. 3, January 21, 2008

52. THz interferometric imaging using subwavelength plastic fiber based THz Endoscopes Ja-Yu Lu, Chung-Chiu Kuo, Chui-Min Chiu, Hung-Wen Chen, Yuh-Jing Hwang, Ci-Ling Pan, and Chi-Kuang Sun
Optics Express, Vol. 16, Issue 4, pp. 2494-2501, February 18, 2008
Virtual Journal for Biomedical Optics, Vol. 3, Iss. 3, March 31, 2008

53. TERAHERTZ AIR-CORE MICROSTRUCTURE FIBER
JA-YU LU, CHIN-PING YU, HUNG-CHUNG CHANG, HUNG-WEN CHEN, YU-TAI LI, CI-LING PAN, AND CHI-KUANG SUN
APPL. PHYS. LETT. 92, 064105 (2008)
Virtual Journal of THz Science and Technology, February 2008

54. TERAHERTZ SCANNING IMAGING WITH A SUBWAVELENGTH PLASTIC FIBER
JA-YU LU, CHUI-MIN CHIU, CHUNG-CHIU KUO, CHIH-HSIEN LAI, HUNG-CHUNG CHANG, YUH-JING HWANG, AND CI-LING PAN
ANALYTICAL CHEM. 92, 084102 (2008)
Virtual Journal of THz Science and Technology, February 2008

55. INTENSE TERAHERTZ EMISSION FROM A-PLANE INN SURFACE
H. AHN, Y.-P. KU, C.-H. CHUANG, C.-L. PAN, H.-W. LIN, Y.-L. HONG, AND S. GWO
APPL. PHYS. LETT. 92, 102103 (2008)
Virtual Journal of THz Science and Technology, March 2008

56. RESONANCE-ENHANCED DIPOLAR INTERACTION BETWEEN TERAHERTZ PHOTONS AND CONFINED ACOUSTIC PHONONS IN NANOCRYSTALS
TZU-MING LIU, JA-YU LU, HUNG-PING CHEN, CHUNG-CHIU KUO, MENG-JU YANG, CHIH-WEI LAI, PI-TAI CHOU, MING-HAO CHANG, HSIANG-LIN LIU, YU-TAI LI, CI-LING PAN, SHIH-HUNG LIN, CHIEH-HSIUNG KUAN, AND CHI-KUANG SUN,
APPL. PHYS. LETT. 92, 093122 (2008)
Virtual Journal of THz Science and Technology, March 2008

VIII. Appendix II：List Of Publications IN "Top" Journals and Conferences (Limit to 3-5)

1. The criteria for top journals and conferences should be defined and stated briefly at the beginning of this section.
2. Please provide electronic files for these publications

"Top" journals are defined by their SCI Impact factor ranking in 2006. Those ranked in the top 1/3 of their catergory are listed as top journals.
Partial List of "Top" Journals (journals that the P.I. published in the period of Apr. 2004 – Feb. 2006) in alphabetical order:

1. Appl. Phys. B [impact factor: 2.023, ranked 20/84 (Physics, Applied), 10/56 (Optics)]
2. Appl. Phys. letters. [impact factor: 3.977, ranked 6/84 (Physics, Applied)]
3. Eelctrochemistry and Solid State Letters [impact factor: 2.009, ranked 35/176 (Materials, Multidisciplinary)]
4. IEEE J. of Lightwave Technology [impact factor: 2.824, ranked 7/206 (EE), 6/56 (Optics)]
5. IEEE Journal of Quantum Electronics [impact factor: 2.262, ranked 18/206 (EE), 16/84 (Physics, Applied)]
6. IEEE Journal of Sel. Top. In Quantum Electron. [impact factor: 2.842, 5/206 (EE), 5/56 (Optics)]
7. IEEE Photonics Technology Letters [impact factor: 2.353, ranked 16/206 (EE), 8/56 (Optics)]
8. Journal of Applied Physics [impact factor: 2.316, ranked 14/84 (Physics, Applied)]
9. Journal of Electrochemical Society [impact factor: 2.387, ranked 1/16 (Materials, Coating and Films)]
10. Journal of Optical society of America B [impact factor: 2.002, ranked 11/56 (Optics)]
11. Nanotechnology [impact factor: 3.307, ranked 9/84 (Physics, Applied), 22/176 (Materials, Multidisciplinary)]
12. Optics Express [impact factor: 4.009, ranked 1/56 (Optics)]
13. Optics Letters [impact factor: 3.598, ranked 2/56 (Optics)]
14. Semiconductor Science and Technology [impact factor: 1.586, ranked 37/206 (EE), 47/176 (Materials, Multidisciplinary)]

Those Conferences with a high reputation and high rejection ratio are considered "top" conferences.

1. CLEO/QELS/IQEC
2. MRS
3. OFC
4. Ultrafast phenomena

A partial list of publications in top journals (less than 5 per area) are list below:

A. Coherent and THz Photonics

1. Wei-Jan Chen, Jhi-Ming Hsieh, Shu Wei Huang, Hao-Yu Su, Chien-Jen Lai, Tsung-Ta Tang, Chuan-Hsien Lin, Chao-Kuei Lee, Ru-Pin Pan, Ci-Ling Pan, and A. H. Kung, "Sub-Single-Cycle Optical Pulse Train with Constant Carrier Envelope Phase," Phys. Rev. Lett., Vol. 100, art. 163906, April 25, 2008.
2. Gong-Ru Lin, Ci-Ling Pan, and I-Hsiang Chiu, "Supermode-noise-free eighth-order femtosecond soliton from a backward dark-optical-comb-injection mode-locked semiconductor optical amplifier fiber laser," Opt. Lett. Vol. 31, No. 6, pp. 835-837, March 15, 2006, selected by Virtual Journal of Ultrafast Science, Vol. 5, No. 6, June 2006.
3. Yi-Chao Wang, Ci-Ling Pan, Jia-Min Shieh and Bau-Tong Dai, "Dopant Profile Engineering by Near-Infrared Femtosecond Laser Activation," Appl. Phys. Lett., Vol. 88, 1311104, March 27, 2006, selected by Virtual

Journal of Nanoscale Science and Technology, Vol. 13, No. 14, April 10, 2006 and Virtual Journal of Ultrafast Science, Vol. 5, No. 4, April 2006.

4. Cho-Fan Hsieh and Ru-Pin Pan, Tsung-Ta Tang, Hung-Lung Chen, and Ci-Ling Pan, "Voltage-controlled liquid crystal terahertz phase shifter and quarter wave plate," Optics Letters, Vol. 31, No. 8, pp. 1112-1114, April 15, 2006, selected by Virtual Journal of THz Science and Technology, April 2006 and OSA Virtual Journal for Biomedical Optics, Vol. 1, No. 5, May 2006.
5. Yu-Kuei Hsu, Ching-Wei Chen, Jung Y. Huang, Ci-Ling Pan, Jing-Yuan Zhang, Chen-Shiung Chang, "Erbium doped GaSe crystal for mid-IR applications," Optics Express, Vol. 14, No. 12, pp. 5484-5491, 12 June, 2006, selected by Virtual Journal of Ultrafast Science, Vol. 5, No. 8, August 2006, and OSA Virtual Journal for Biomedical Optics, Vol. 1, No. 7, July 2006.

B. Quantum (Photonic Crystal) Structures and Enabling Devices

1. C. H. Chiu, T. C. Lu, H. W. Huang, C. F. Lai, C. C. Kao, J. T. Chu, C. C. Yu, H. C. Kuo, and S. C. Wang, C. F. Lin, T. H. Shueh, "Fabrication of InGaN/GaN MQW nanorods LED by ICP-RIE and PEC oxidation process with self-assembly Ni metal islands", Nanotechnology, V18, N.44, p445201, Nov. 7, 2007
2. **C. E. Lee, Y. J. Lee, H. C. Kuo, M. R. Tsai, B. S. Cheng, T. C. Lu, S. C. Wang, C. T. Kuo, "**Enhancement of Flip-Chip Light-Emitting Diodes With Omni-Directional Reflector and Textured Micropillar Arrays**", IEEE Photon. Tech. Lett., V19, No16, pp1200-1202, Aug. 15, 2007.**
3. Chun-Feng Lai, Peichen Yu, Te-Chung Wang, Hao-Chung Kuo, Tien-Chang Lu, Shing-Chung Wang and Chao-Kuei Lee "Lasing Characteristics of a GaN Photonic Crystal Nanocavity Light Source", Appl. Phys. Lett., V91, 041101, Jul. 23, 2007.
4. YS Liao, JW Shi, YS Wu, HC Kuo, M Feng, GR Lin," Optically heterodyne diagnosis of a high-saturation-power undoped InP sandwiched InGaAs p-i-n photodiode grown on GaAs" Optics Express 14 (12): 5031-5037 JUN 12 2006.
5. PC Peng, WR Peng, KM Feng, HY Chiou, J Chen, HC Kuo, SC Wang, S Chi," OCDMA light source using directly modulated Fabry-Perot laser diode in an external injection scheme" IEEE Photonics Technology Letters 18 (9-12): 1103-1105 MAY-JUN 2006.

C. Volume Holographic Materials, Technology and Enabling Devices

1. Shiuan-Huei Lin, Po-Lin Chen, Yi-Nan Hsiao and Wha-Tzong Whang, "Fabrication and Characterization of poly (methyl methacrylate) photopolymer doped with 9,10-Phenanthrenequinone (PQ) based derivatives for volume holographic data storage", Optics Communications, Vol. 281, pp. 559-566, 2008.
2. V. Marinova, D. Petrova, S. H. Lin and K.Y. Hsu, "Light-induced and holographic properties of Fe+Mn doubly-doped $Bi_4Ge_3O_{12}$ crystals", Optics Communications, Vol. 281, pp. 37-43, 2008.
3. Shiuan-Huei Lin, Yi-Nan Hsiao, Ken Y. Hsu and Wha- Tzong Whang, "Poly (methyl methacrylate-co-hydroxyethyl methacrylate) photopolymer doped with photoinitiator system Eosin Y Spirit Soluble/Triethanolamine for holographic data storage," in press, J. Optical Memory & Neural Networks, 2008.
4. Shiuan Huei Lin, Po-Lin Chen, Jung-Hwa Lin, Yi-Nan Hsiao and Ken Y. Hsu, "Phenanthrenequinone-doped copolymers for volume holographic data storage applications," submitted to Optical Engineering, 2008.
5. D. Petrova, V. Marinova, R. C. Liou, S. H. Lin and K.Y. Hsu, "Characterization of doped $Bi_4Ge_3O_{12}$ single crystals by light-induced, electrical and photoelectrical measurements" J. of optoelectronics and advanced material, Vol. 9, No. 2, p. 282 – 285, February 2007.

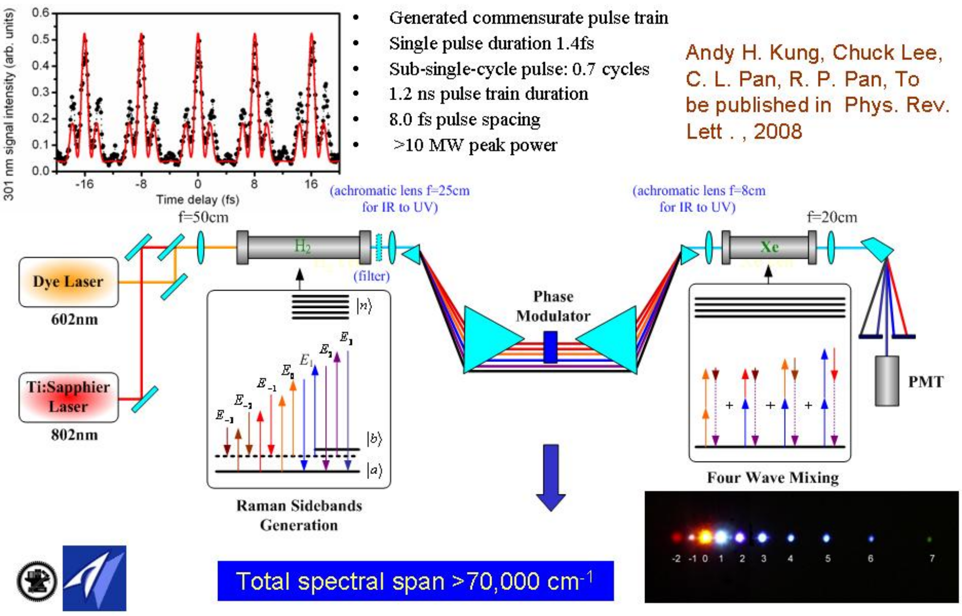
IX. APPENDIX IV: SLIDES ON SCIENCE AND TECHNOLOGY BREAKTHROUGHS

(TWO SLIDES FOR EACH BREAKTHROUGH)

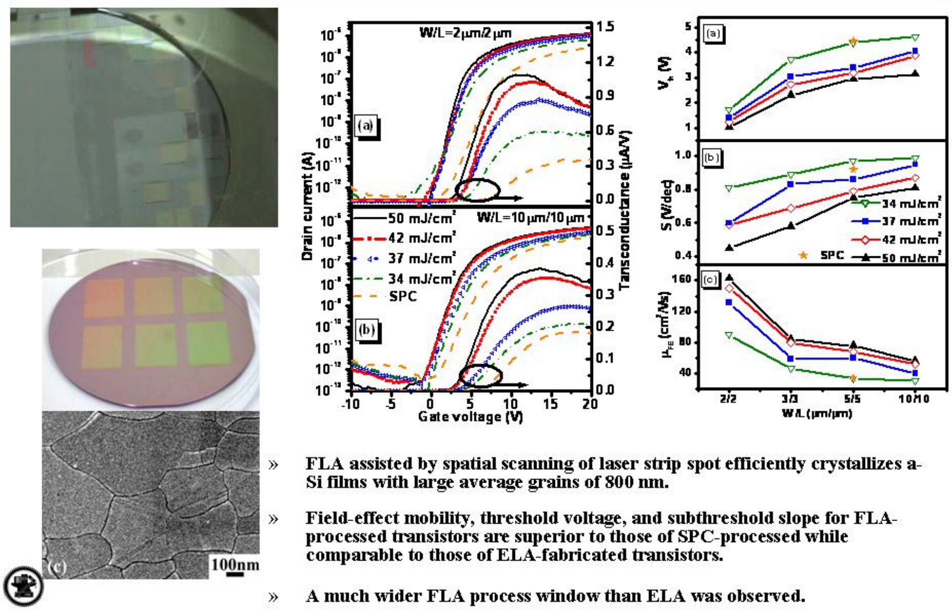
Slides on Science And Technology Breakthroughs (Two Slides for each Breakthrough)

SUB-I :

Sub-Single-Cycle and multi-THz rep rate Optical Pulse Train with Constant Carrier Envelope Phase



Near-infrared femtosecond laser crystallized poly-Si thin film transistors

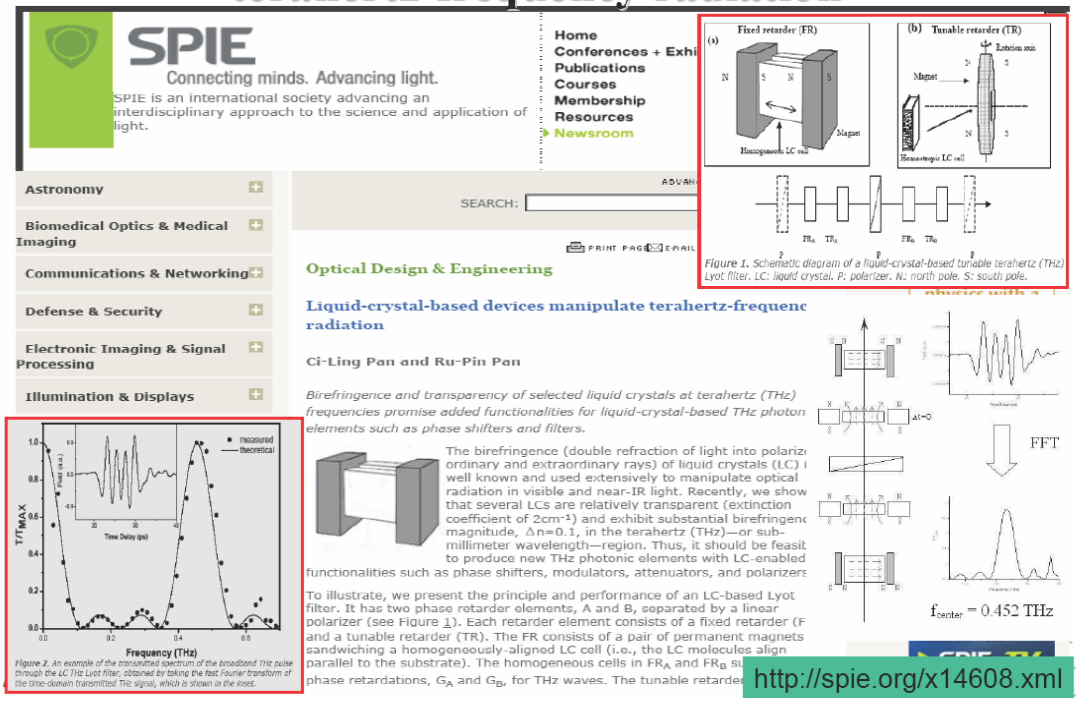


» FLA assisted by spatial scanning of laser strip spot efficiently crystallizes a-Si films with large average grains of 800 nm.

» Field-effect mobility, threshold voltage, and subthreshold slope for FLA-processed transistors are superior to those of SPC-processed while comparable to those of ELA-fabricated transistors.

» A much wider FLA process window than ELA was observed.

Liquid-crystal-based devices manipulate terahertz-frequency radiation


SPIE
Connecting minds. Advancing light.
SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Home
Conferences + Exhi
Publications
Courses
Membership
Resources
Newsroom

Astronomy
Biomedical Optics & Medical Imaging
Communications & Networking
Defense & Security
Electronic Imaging & Signal Processing
Illumination & Displays

SEARCH:

Optical Design & Engineering

Liquid-crystal-based devices manipulate terahertz-frequenc radiation

Ci-Ling Pan and Ru-Pin Pan

Birefringence and transparency of selected liquid crystals at terahertz (THz) frequencies promise added functionalities for liquid-crystal-based THz photon elements such as phase shifters and filters.

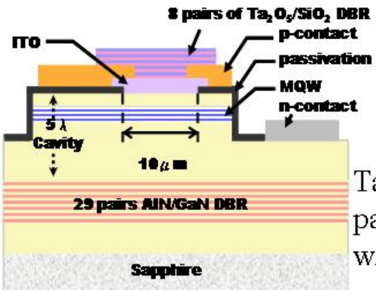
The birefringence (double refraction of light into polariz ordinary and extraordinary rays) of liquid crystals (LC) i well known and used extensively to manipulate optical radiation in visible and near-IR light. Recently, we show that several LCs are relatively transparent (extinction coefficient of 2cm⁻¹) and exhibit substantial birefringenc magnitude, Δn=0.1, in the terahertz (THz)—or sub-millimeter wavelength—region. Thus, it should be feasit to produce new THz photonic elements with LC-enabled functionalities such as phase shifters, modulators, attenuators, and polarizers

To illustrate, we present the principle and performance of an LC-based Lyot filter. It has two phase retarder elements, A and B, separated by a linear polarizer (see Figure 1). Each retarder element consists of a fixed retarder (F and a tunable retarder (TR). The FR consists of a pair of permanent magnets sandwiching a homogeneously-aligned LC cell (i.e., the LC molecules align parallel to the substrate). The homogeneous cells in FR_A and FR_B su phase retardations, G_A and G_B, for THz waves. The tunable retarder

Figure 1. Schematic diagram of a liquid-crystal-based tunable terahertz (THz) Lyot filter. LC: liquid crystal. P: polarizer. N: north pole. S: south pole.

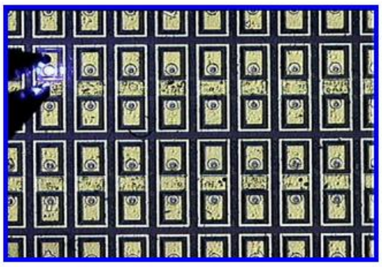
Figure 2. An example of the transmitted spectrum of the broadband THz pulse through the LC THz Lyot filter, obtained by taking the fast Fourier transform of the time-domain transmitted THz signal, which is shown in the inset.

Electrically pumped GaN VCSEL @ 77K

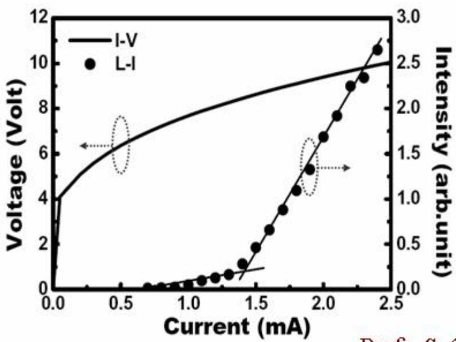


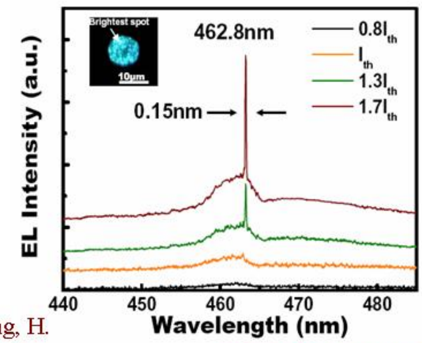
1st such devices reported to date!

Taiwan and US patents filed w/NCTU



1480 devices/cm²





NCTU J_{th} ~ 1.8 KA/cm²

Profs. S. C. Wang, H. C. Kuo and T. C. Lu

Excellence in Photonics

compoundsemiconductor.net

RELATED STORIES

- AlInN mirrors spur VCSEL progress
- Atomic clocks throw down the gauntlet to VCSEL makers

RELATED LINKS

- Shing-Chung Wang's home page
- Appl. Phys. Lett. 92 141102

NEWS

Apr 21, 2008

GaN VCSEL delivers electrically pumped lasing

GaN VCSELs are now producing electrically pumped lasing thanks to superlattice structures in the n-type mirror and indium tin-oxide coating of the aperture.

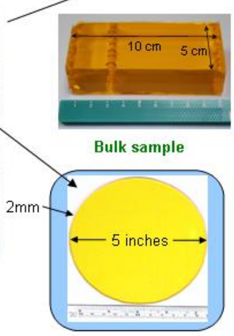
Shing-Chung Wang and colleagues from National Chiao Tung University, Taiwan, have produced the first ever electrically pumped GaN VCSEL.

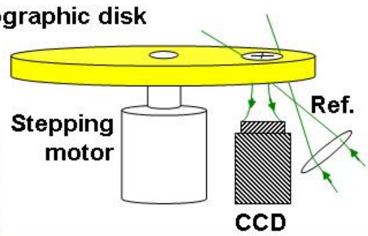
The laser, which has the potential to be used in high-density optical storage and laser printing applications, produced continuous-wave 462 nm emission with a linewidth of 0.15 nm at 77K.

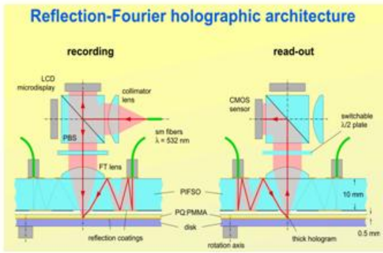
Details of the device, the culmination of eight years of VCSEL development, were reported in the 7 April issue of Applied Physics Letters (*App. Phys. Lett.* 92 141102).

Holographic disk for 3D volume storage: Advances in New Materials

1. **Storage capability ~> 420GB/disk**
2. **Storage speed: ~ 117 Mb/sec**
3. **X 10s of times of Blu-DVD**







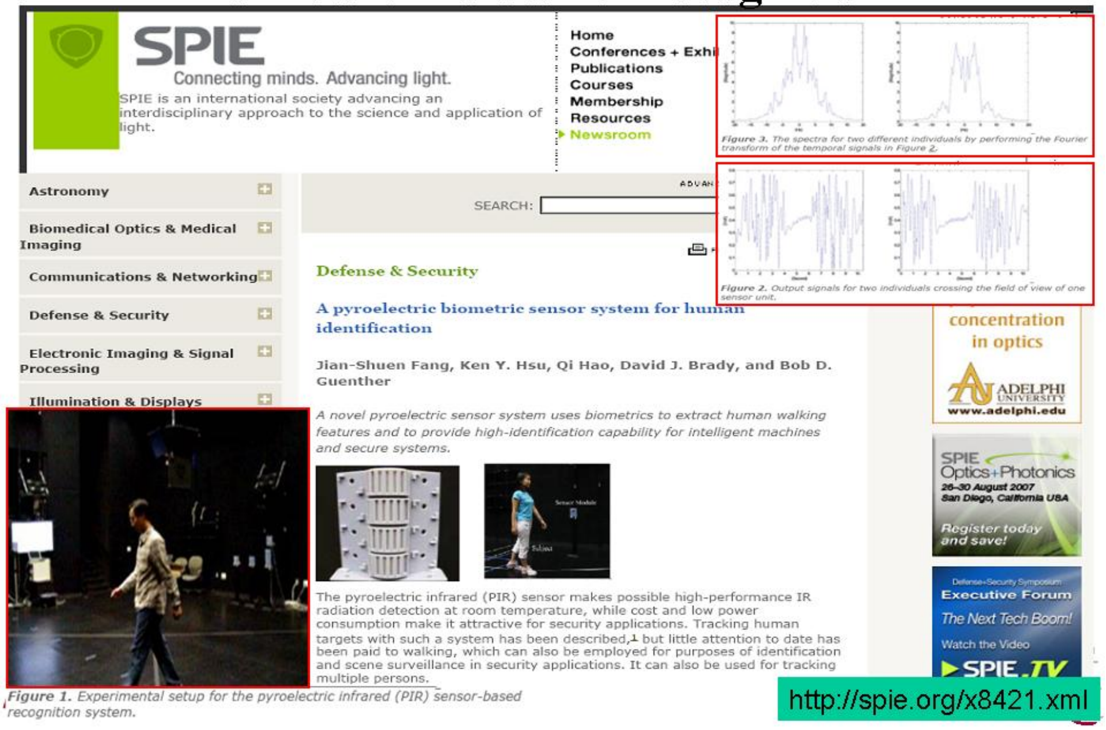
The Optical Storage Open Laboratory
Left: Photopolymer Fabrication Laboratory
Right: Holographic storage test platform

1. J. of Non. Opt. Phys. and Mats., Vol. 15(2), 239, 2006.
2. Jpn. J. Appl. Phys., 45(11), 8699-8704, 2006.
3. J. of optoelectronics and advanced material, 2006.
4. Proc. DGaO (2007), p. 47 (2007)

Technology transfer: CMC中環

NCTU　*Matthias Gruber---Fern University in Hagen,Germany　Excellence in Photonics 卓越

A Biometric optoelectronic system for real-time walker recognition



X. APPENDIX V: FINAL SELF-ASSESSMENT

PROGRAM TITLE: 子計畫一：兆位元時代光電科技之基礎研究
Subproject 1: Fundamental Studies on Photonic Science and Technology for the Tera Era

	ASSESSMENT SUBJECT	SCORE（1~5, LOW TO HIGH）
PROGRAM'S CONTENTS & PERFORMANCE	Importance & Innovation of the Program's Major Tasks	5
	Clarity and Presentation of the Report	4.5
	Viability of the Program's Approaches & Methodologies	5
	Principal Investigator's Competence for Leading the Program	5
	Interface & Integration between Overall & Sub-Project(s)	4
	Interface & Integration among All Sub-Projects	4
	Manpower & Expenditures	4.5
PROGRAM'S RESULTS	Contribution in Enhancing the Institute's International Academic Standing	5
	Impact on Advancing Teaching or on Technology Development	5
Total Score		42

Program Reviewer's Signature: Cheng-Chung Lee 2008/05/30

REVIEWER'S COMMENTS & SUGGESTION:

This is the summary of six viewers' comments and suggestions.

1. Overall, this project has achieved some rather unique and innovative research results in 3 research areas—**V**olume Holograph, Photonic Science and Technology and THz photonics with very good performance in journal and conference paper.
2. The budget table did not give a total sum of either the entire program or the projects. An inclusion of such information would help the reviewer a lot to spot the major figures.
3. Interface and integration between each sub-projects was not very clear, particularly the link of the fundamental research to applications.
4. After publishing many papers and getting many patents, should the group think about: a) focus on a few topics and demonstrate something of significance to lead the science and technology in this field; b) do collaboration with an industrial group which has integration and system know-how to make real impact of the THz technology.

PRINCIPLE INVESTIGATOR'S FEEDBACK: (AVAILABLE)

REVIEWER'S COMMENTS & SUGGESTION:

This is the summary of six viewers' comments and suggestions.

1. Overall, this project has achieved some rather unique and innovative research results in 3 research areas—**V**olume Holograph, Photonic Science and Technology and THz photonics with very good performance in journal and conference paper.

2. The budget table did not give a total sum of either the entire program or the projects. An inclusion of such information would help the reviewer a lot to spot the major figures.

Reply: The report has been revised to include budget information of the whole project and the three topical areas.

3. Interface and integration between each sub-projects was not very clear, particularly the link of the fundamental research to applications.

Reply: Fundamental studies are essential for the success and achievements of the current project. We list several collaboration projects that integrate fundamental studies and applied science that result in outstanding results.

a). Using the adaptive coherent control technique, Profs. Jung Y. Huang and C. L. Pan (SP-1) studied semiconductor saturable absorber mirrors fabraicated by Prof. Jen-Inn Chyi (SP-3) and achieved a three-time increase in image contrast on regions with photoluminescent wavelength of InAs quantum dots differing only 18 nm by using coherent control nonlinear optical microscopy [JOSA B 22:1134 (2005), selected by the Virtual J. Ultrafast Sci., 2005]. Saturable absorber mirrors are key devices for modelocking of ultrafast lasers. The novel microscopic technique also allows more insights into the InA quantum dots.

b). A few types of THz antennas and photonic transmitters that were fabricated on epi-layers grown in Prof. Jen-Inn Chyi's lab and fabricated by Prof. Jin-Wei Shi. [IEEE Photon. Technol. Lett., Vol. 19, No. 11 pp. 840-842, June 1, 2007, to be published ,2008].

c). Within SP-1, Profs. H. C. Kuo, Jung Y. Huang, and C. –L. Pan collaborated in the development and elucidation of mechanisms of Enhanced photoresponse by a Metal-Oxide-Semiconductor photodetector with Si nanocrystals embedded in the oxide layer [Appl. Phys. Lett., Vol. 90, art. 051105, January 30, 2007]. Further, semiconductor THz quantum cascade laser (QCL) is a promising candidate for THz sources for the next-generation. Especially, QCLs with GaN-based quantum well structures have significant advantages over the currently demonstrated THz lasers in the GaAs-based material system. From the understanding of the fundamental material properties, we are working on the development of such high-performance THz QCLs.

d) Liquid crystal spatial light modulators developed by SP-1 were useful for DWDM optical communication systems [Optics Express, 12 (26):6434, 2004, Taiwan Patent I223484, US patent filed; IEEE Photon. Technol.

Lett., 40(10):2254, 2004, ROC patent disclosed, 2006; Opt. Comm. 278:329, 2007] and key component for the generation of sub-single-cycle, sub-femtosecond optical pulses [Phys. Rev. Lett., Vol. 100, art. 163906, April 25, 2008, selected by Virtual Journal of Ultrafast Sciences, May 2008].

e) The physical mechanism of holographic recording in doped PMMA has also been investigated. This provides hints to improve holographic properties that allows demonstration of 3D holographic storage up to ~ 450 GB on a five-in disk.

4. After publishing many papers and getting many patents, should the group think about: a) focus on a few topics and demonstrate something of significance to lead the science and technology in this field; b) do collaboration with an industrial group which has integration and system know-how to make real impact of the THz technology.

a) In executing PPAEU-II, we always strived for achieving outcomes of highly impact. The publication of papers and patents are just byproducts of the research efforts. Although there are indeed a diverse range of research outcomes, one realizes quickly that many are of extremely high impact. To name just a few:

i) Quasi-optic components with functionalities are critical for the advance of THz science and technology. We have pioneered the field of liquid crystal THz photonics. To name just a few achievements, we report the only room-temperature magnetic-field- or electric-field-tunable THz phase shifter capable of phase shift of more than 2π at 1 THz as well as broadband tunable THz filters [reported by SPIE Newsroom]., waveplates, polarizers and phase gratings

ii) Low-loss microstructured THz waveguide was demonstrated and its waveguiding mechanism was elucidated. This work was highlighted by Nature Photonics, April 2008.

iii) The first ever electrically pumped GaN VECSEL was demonstrated. This work was highlighted by CLEO 2008 as one of the hot topics and reported by Compound Semiconductor and Laser Focus Magazines.

iv) Sub-tera-byte 3D holographic storage (~450GB) was demonstrated for a 5-inch photoplymer disk.

b) We have transferred THz technology to ITRI that has more experiences in industrialization of scientific breakthroughs. A pilot project has been initiated with Chimei on biomedical application of THz technology.

Program Reviewer's Signature:____________________