

行政院國家科學委員會補助專題研究計畫 成果報告
 期中進度報告

新世代顯示科技人才培育研討會計畫

計畫類別： 個別型計畫 整合型計畫

計畫編號：NSC - 92 - 3114 - P - 002 - 002 - Y

執行期間：92 年 6 月 1 日至 93 年 5 月 31 日

計畫主持人：楊志忠

共同主持人：

計畫參與人員：馮哲川教授、江衍偉教授、吳忠幟教授、邱奕鵬教授、
何旻真教授、李君浩教授、簡嘉葳（專任助理）

成果報告類型(依經費核定清單規定繳交)： 精簡報告 完整報告

本成果報告包括以下應繳交之附件：

- 赴國外出差或研習心得報告一份
- 赴大陸地區出差或研習心得報告一份
- 出席國際學術會議心得報告及發表之論文各一份
- 國際合作研究計畫國外研究報告書一份

處理方式：除產學合作研究計畫、提升產業技術及人才培育研究計畫、
列管計畫及下列情形者外，得立即公開查詢

涉及專利或其他智慧財產權， 一年 二年後可公開查詢

執行單位：國立台灣大學光電工程學研究所

中華民國 93 年 7 月 1 日

目 錄

中文摘要	2
英文摘要	3
一、前言	4
二、目的	4
三、方法	5
1. 研討會時間	5
2. 研討會地點	5
3. 參加學員	5
4. 研討會議程、授課教師及講題	7
【第一階段】	7
【第二階段】	8
5. 第一階段講員及授課摘要	15
6. 第二階段受邀講者及講題	16
7. 經費使用說明	18
(1) 原始經費申請表	18
(2) 修正後經費使用表	19
(3) 報名費實際收入狀況	20
(4) 國科會補助部份餘款繳回說明	20
(5) 實際支出一覽表	21
8. 來訪外國學者對此研討會之觀感	22
9. 參加人才培育研討會學員獲益情況	22
四、結論與建議	23

中文摘要

關鍵字： 影像顯示技術、液晶顯示、有機高分子發光顯示、白光光源、光微機電技術

為配合我國顯示技術產業發展及政府推動相關技術的提昇，本計畫以前瞻性技術為主，邀請五位海外著名專家學者，針對液晶顯示、有機高分子發光顯示、白光光源、光微機電技術等與顯示技術發展相關課程，從事人才培育工作。此五位學者講課精彩，參加者踴躍，感覺受益良多。

英文摘要

Keywords: Display technology, liquid crystal display, organic/polymer light-emitting display, white light source, optical micro-electro-mechanical system

Based on the policy of display-technology promotion of the Government and the man power need in Taiwan display industry, in this project we invited five well-known scholars for introducing novel display techniques at the organized workshop. Their topics at the workshop include liquid crystal display, organic/polymer light-emitting display, white-light source, and optical micro-electro-mechanical system. This workshop meant to introduce the up-dated developments of the display technology in the technology-leading countries to the local researchers. The five scholars have made excellent presentations. Sixty-four attendees have be well educated during the workshop.

一、前言

在我國各項高科技產業發展中，顯示科技無疑是下一顆閃亮的星星。顯示科技（包括照明）之應用無所不在，包括電腦、手機、電視、汽車、公共場所告示板、交通訊號、室內外照明等，其所代表之產值不可限量。目前，顯示照明技術包括半導體 LED、有機高分子 LED、LCD 及電漿顯示。我國於顯示相關產業上，在資訊與通訊產業配合下成長極為快速，在半導體 LED 方面，我國素有王國之美譽，近年來，投入以氮化鎵為主要材料之藍綠光與白光 LED 之廠家及資本額更是大增，其營運狀況頗佳，尤其白光 LED 因具有突破性之新照明技術潛力，其市場價值更是令相關業者積極投入。在有機高分子 LED 方面，已有數百億的投資額，在製作輕巧低廉的顯示看板上，競爭力極強。以近幾年投資增加量來看，我國 LCD 產業極為亮麗，產業投資已有數千億台幣，2002 年中，我國在大型 TFT-LCD 之產量已達世界佔有率之 36.1%，而產值也達 34.3%，名列全球第二，逐步逼近世界第一的南韓。至於電漿顯示，也有多家業者自日本引進技術，積極發展。

顯示照明產業積極發展之同時，相關前瞻性技術之開發更顯得需要，半導體 LED 及有機高分子 LED 之發展中，新型技術與學理的發揮空間仍然極大，即使如 LCD 與電漿顯示技術較成熟，仍有許多相關工程問題亟待解決，以增加產能，降低成本。因此，引進並發展顯示照明前瞻性科技對我國目前相關產業之需求，實刻不容緩。在人才培育方面，也需要兼顧目前急迫需求與長遠規劃兩部分。

二、目的

為抒解目前 LCD 產業人力暫時性之需求，國立交通大學已著手規劃相關種子教師之培育工作，計畫從國外邀請數位 LCD 相關專家回國授課，培養大專院校種子教師。另外，光電產業促進會 (PIDA) 也將於本年四月至八月間，假台北舉行三期的平面顯示器培訓班，也是針對 LCD 產業需求，培訓急需的產業技術人員。上述兩項人才培育工作，都只限於 LCD，而且僅傳授現有成熟的技術，並不涉及創新前瞻性部分，此誠為協助我國顯示產業人才培育中之不足處。為此，本人才培育計畫擬配合已籌備一年之第五屆環太平洋雷射與光電研討會（乃世界最大、最高水準之光電研討會之一），舉辦一個人才培育研討會，邀請五名世界上相關領域知名學者，講述顯示技術前瞻性發展，以提供國內相關從業人員技術提昇之契機。

三、方法

1. 研討會時間：92年12月13~19日共6.5日

【修正說明】原申請計畫書中擬邀請學者專家共13位並舉辦6.5日，但因所提預算經刪減後無法支付原邀請之13位學者專家全部出席，再因SARS疫情影響而延期舉行，導致原邀請之學者專家有部份無法更改其原訂行程而出席。因此，我們將本研討會分成兩階段，第一階段邀請五位國外專家學者，進行為期2.5日之短期課程。第二階段由學員免費參加「第五屆環太平洋地區雷射與光電國際研討會(CLEO/PR 2003)」，尤其安排他們參加顯示科技有關之節目共4天，分享各國學者專家之研究成果。因此，本研討會兩階段共計6.5日

2. 研討會地點：台灣大學電機二館143、105室（第一階段） 台北圓山大飯店107室、國際會議廳及松柏廳（第二階段）

3. 參加學員共64人，名單如下：

姓名	單位	職稱
張翼青	國防大學中正理工學院應用物理系	副教授
林坤榮	銖寶科技股份有限公司	經理
劉華光	國立台灣大學光電工程研究所	教授
李君浩	台灣大學光電工程學研究所	助理教授
陳熊光	工業影像顯示產業推動辦公室	顧問
李晁達	交通大學光電工程學研究所	博士生
傅光宇	國立彰化師範大學光電所	研究生
陳國政	國立中正大學	研究生
陳志宏	國立中正大學	研究生
陳均合	交通大學光電工程學研究所	研究生
邱浩璋	交通大學光電工程學研究所	研究生
王俊傑	交通大學光電工程學研究所	研究生
詹孟熙	交通大學光電工程學研究所	研究生
莊喬舜	交通大學光電工程學研究所	研究生
林銘彥	國立虎尾技術學院光電與材料科技研究所	研究生
許順成	中興大學材料所	研究生
陳裕宏	台灣大學應用力學研究所	研究生
黃進發	中山大學公共事務研究所	研究生
蕭智鴻	台灣大學電機工程學系	大四
張孝慷	台灣大學電機工程學系	大四
林立峰	台灣大學光電工程學研究所	碩一

彭康峻	台灣大學光電工程學研究所	碩一
陳致堯	台灣大學光電工程學研究所	碩一
黃信發	台灣大學光電工程學研究所	碩一
李冠儒	台灣大學光電工程學研究所	碩一
任芳儀	台灣大學光電工程學研究所	碩一
李正匡	台灣大學光電工程學研究所	碩一
盧彥丞	台灣大學光電工程學研究所	碩一
金書正	台灣大學光電工程學研究所	碩一
吳佳芳	台灣大學光電工程學研究所	碩一
柯統輝	台灣大學光電工程學研究所	碩一
蕭嘉強	台灣大學光電工程學研究所	碩一
吳翊魁	台灣大學光電工程學研究所	碩一
朱怡欣	台灣大學電子工程學研究所	碩一
洪紹軒	台灣大學光電工程學研究所	碩一
劉耀仁	台灣大學光電工程學研究所	碩一
王崧豐	台灣大學光電工程學研究所	碩一
林威呈	台灣大學光電工程學研究所	碩二
陳銘鋒	台灣大學光電工程學研究所	碩二
陳政吉	台灣大學光電工程學研究所	碩二
陳彥豪	台灣大學光電工程學研究所	碩二
陳孟谷	台灣大學光電工程學研究所	碩二
陳俊陽	台灣大學光電工程學研究所	碩二
林仕駿	台灣大學光電工程學研究所	碩二
王自豪	台灣大學光電工程學研究所	碩二
鄧智中	台灣大學光電工程學研究所	碩二
蔡世宇	台灣大學光電工程學研究所	碩二
紀淳詠	台灣大學光電工程學研究所	碩二
梁啟源	台灣大學光電工程學研究所	碩二
唐宗毅	台灣大學光電工程學研究所	博一
徐兆慶	台灣大學光電工程學研究所	博一
陳正言	台灣大學光電工程學研究所	博一
呂志鋒	台灣大學光電工程學研究所	博一
趙家忻	台灣大學光電工程學研究所	博一
陳永昇	台灣大學光電工程學研究所	博二
蔡孟燦	台灣大學光電工程學研究所	博二
王義閔	台灣大學光電工程學研究所	博二
王祥辰	台灣大學光電工程學研究所	博三
呂志偉	台灣大學光電工程學研究所	博三
陳鴻祥	台灣大學光電工程學研究所	博四
鐘國晉	台灣大學光電工程學研究所	博二
黃吉豐	台灣大學光電工程學研究所	博一
戴忠宏	台灣大學電子工程學研究所	博二
陳芳志	台灣科技大學電子所	研究生

【修正說明】 原申請計畫書中預計培育人數 100 人，因 SARS 疫情

而延期，可能因宣傳不力，導致學員報名參加不夠踴躍，但實際執行效果卓著，參加學員普遍反應及建議如下：

1. 所邀顯示科技之講員的確為這方面領域之先驅與菁英，能邀請其參與實難能可貴。
2. 講員授課內容豐富，授課技巧熟練，教材難易適中，收穫良多。
3. 建議每年均能邀請國際相關領域知名學者專家訪台授課。

4. 研討會議程、授課教師及講題（分第一階段及第二階段）

【第一階段】

	December 13 週六 電機二館 143 室	December 14 週日 電機二館 105 室	December 15 週一 電機二館 105 室
09:00 12:00	Prof. H. S. Kwok <i>“Liquid Crystal on Silicon Microdisplays”</i>	Prof. Ghassan E. Jabbour <i>“Principles and Fabrication of Nanothick Molecular and Polymeric Light-Emitting Devices”</i>	Prof. Ian T. Ferguson <i>“Introduction to Solid State Lighting in General Illumination”</i>
14:00 17:00	Dr. Guo-Dung Su <i>“An Introduction to Optical MEMS and Its Application for Displays”</i>	Dr. T. Takebe <i>“Development of ZnSe-based white LEDs”</i>	

【第二階段】

Auditorium → (107)

14:00-15:30
TU3C • Fundamentals of
Photonic Crystal and Photonic
Crystal Fibers
S. Noda, Kyoto University,
Japan, Presider

14:00-15:00 TU3C-(16)-1
(Tutorial)
Photonic crystals - new
materials for 21st century
Eli Yablonovitch
UCLA, USA

Room 107 → (107)

14:00-15:30
TU3E • Solid-State Lighting (I)
J. -I. Chyi, National Central
University, Taiwan, Presider

14:00-14:30 TU3E-(SS1)-1
(Invited)
ZnSe-based white LED
Toshihiko Takebe
Sumitomo Electric Industries, Ltd.,
Japan
A phosphor-free ZnSe-based
high-brightness white LED operating at
very low voltages is demonstrated. The
optical output power and operating
voltage of a typical device at a forward
current of 20mA is 6.8mW and 2.5V,
respectively.....

14:30-14:45 TU3E-(SS1)-2
Infrared reflectance studies of
GaN grown on sapphire by
metalorganic chemical vapour
deposition
Z. C. Feng, I. Ferguson, Y. T. Hou,
and T. R. Yang
Georgia Institute of Technology,
USA; National Taiwan University,
Taiwan; National University of
Singapore, Singapore; National
Taiwan Normal University, Taiwan
Infrared reflectance of GaN grown on
sapphire by metalorganic vapour
deposition has been studied
theoretically/experimentally.
Comprehensive theoretical calculations
have been made and compared with
experimental data, evidencing a good
technique for characterising GaN
epilayers.

14:45-15:00 TU3E-(SS1)-3
Effects of thermal annealing on
InGaN/GaN quantum well
structures with silicon doping
Yung-Chen Cheng, En-Chiang Lin,
Shih-Wei Feng, Hsiang-Chen
Wang, C. C. Yang, Kung-Jen Ma,
Shih-Chen Shi, L. C. Chen,
Chang-Chi Pan, and Jen-Inn Chyi
National Taiwan University; Chung
Hua University; National Central
University, Taiwan
The effects of thermal annealing on the
optical properties and material
structures of InGaN/GaN quantum wells
with silicon doping were studied to find
that the material microstructures
alteration was the major reason for the
changes.

Ever-Green Room → (108)

10:30-12:30
TH2B • Quantum Dot Physics
and Application (I)
G. Solomon, Stanford
University, USA, Presider

10:30-11:00 TH2B-(SS2)-1
(Invited)
Progress in MOCVD grown
quantum dot lasers
D. Huffaker
University of New Mexico, USA

11:00-11:30 TH2B-(SS2)-2
(Invited)
Spontaneous emission
properties of position-controlled
quantum dots in microdisk
cavities
G. S. Solomon
Stanford University, USA

Auditorium - (10F)

TU3C • Fundamentals of Photonic Crystal and Photonic Crystal Fibers --- continued

15:00-15:15 TU3C-(16)-2
A novel periodic structures in photonic crystal fibers
Jung-Sheng Chiang and Tzong-Lin Wu
National Sun Yat-Sen University, Taiwan
 An octagon periodic structure of photonic crystal fibers, where the air holes lie on octagonal period, is investigated in this work base on a full-wave simulation. Under the same air filling fraction with the hexagonal structure.....

15:15-15:30 TU3C-(16)-3
Design, fabrication, and characterization of microstructured polymer optical fibers
C. -W. Huang, M. -C. Ho, H. H. Chien, K. J. Ma, Z. P. Zheng, C. P. Yu, H. C. Chang, and C. C. Yang
National Taiwan University; Chung-Hua University, Taiwan
 Fabrication and characterization of microstructured polymer optical fibers (MPOFs) are presented. The effects of drawing temperature and heating time during the fabrication processes are studied. The fibers exhibit single-mode characteristics as predicted by numerical simulation.

16:00-18:00
 TU4C • Photonic Crystal and Devices for Communications
 E. Yablonovitch, UCLA, USA, Presider

16:00-16:30 TU4C-(16)-1 (Invited)
Photonic crystal WDM components
Thomas F. Krauss
University of St. Andrews, UK

Room 107 - (10F)

TU3E • Solid-State Lighting (I)
 --- continued

15:00-15:15 TU3E-(SS1)-4
Enhancement of light extraction of GaN-based LED with introducing micro-structure array
Chao-Ying Lin, Tsung-Xian Lee, Shi-Xin Ma, and Ching-Cherng Sun
National Central University, Taiwan
 Optical models for simulating light extraction efficiency of an GaN-based LED chip is presented. We propose to introduce a periodic sharpening structure on the interface between the sapphire and the n-GaN of a GaN-based LED to obtain as high as 73% in light extraction efficiency.

15:15-15:30 TU3E-(SS1)-5
Metallic wafer and chip bonding for led packaging
C. C. Hsu, S. J. Wang and C. Y. Liu
National Central University, Taiwan
 Metallic bonding is a most effective way to simultaneously provide good thermal dissipation and ohmic contact for LED chip assembly. For the two current LED chip assemblies, i.e., wiring and flip-chip bonding, metallic bonding is seriously involved to improve the efficiency of LED.

16:00-17:45
 TU4E • Solid-State Lighting (II)
 J. T. Hsu, Industrial Technology Research Institute, Taiwan, Presider

16:00-16:30 TU4E-(SS1)-1 (Invited)
GaN LEDs for solid-state lighting
V. Haerle
OSRAM Opto Semiconductor, Germany

Ever Green Room - (10F)

TH2B • Quantum Dot Physics and Application (I)--- continued

11:30-12:00 TH2B-(SS2)-3 (Invited)
Optical characterization of strong carrier-phonon interactions in single quantum dots
Y. Toda, T. Inoue, T. Nakaoka, S. Ishida, and Y. Arakawa
Hokkaido University; PRESTO JST; University of Tokyo, Japan
 Phonon-assisted transitions in single self-assembled InGaAs quantum dots are investigated by photoluminescence (PL) and PL excitation (PLE) spectroscopy. Under nearly resonant conditions of the excitonic ground state, a broad sideband is observed in both PL and PLE.....

12:00-12:30 TH2B-(SS2)-4 (Invited)
Growth and optical properties of GaN-based quantum dots
Hyun Jin Kim, Hyunseok Na, Soon-Yong Kwon, Young-Woon Kim and Euijoon Yoon
Seoul National University
 GaN-based quantum dots were grown by low-pressure metalorganic chemical vapor depositions. High-density In-rich InGaN/GaN quantum dots were successfully grown by low temperature growth. In-rich InGaN/GaN quantum dots showed enhanced emission properties whose wavelength.....

16:00-17:45
 TH4B • Quantum Dot Physics and Devices (II)
 D. Huffaker, University of New Mexico, USA, Presider

16:00-17:00 TH4B-(SS2)-1 (Tutorial)
Growth and physics of quantum dots for optoelectronics applications
Y. Arakawa
University of Tokyo, Japan

TU4C · Photonic Crystal and Devices for Communications
--- continued

16:30-17:00 TU4C-(16)-2
(Invited)

Manipulation of photons by artificial defects in photonic crystals

*Susumu Noda
Kyoto University, Japan*

17:00-17:15 TU4C-(16)-3
Design and characterization of a coupling-strength-controlled directional coupler based on photonic crystal waveguide
Y. Sugimoto, Y. Tanaka, N. Ikeda, T. Yang, H. Nakamura, K. Inoue, K. Miyashita, T. Maruyama, K. Ishida, Y. Watanabe, and K. Asakawa
The Femtosecond Technology Research Association; Chitose Institute of Science and Technology; National Institute of Advanced Industrial Science and Technology, Japan
Numerical and experimental studies on photonic crystal waveguide directional couplers (DCs) with coupling-strength-control defects are reported. Fundamental operation as the DC at a wavelength of ~1.3 μm is observed.....

17:15-17:30 TU4C-(16)-4
Wavelength division multiplexing for 1.3 and 1.55 micron by photonic crystal directional couplers
Chii-Chang Chen, Chih-Yu Chen, S. C. Yang, W. K. Wang, C. K. Lin, and Yi-Jen Chan
National Central University, Taiwan
We report the photonic crystal directional couplers to separate the wavelengths for 1.3 and 1.55 μm . The extinction ratios of the output ports is around 10dB. This structure can be used to realize the PC nano-detection system for WDM purpose.

TU4E · Solid-State Lighting (II)
--- continued

16:30-17:00 TU4E-(SS1)-2
(Invited)

New approach of efficiency enhancement on GaN LED devices

*J. T. Hsu
ITRI, Taiwan*

17:00-17:15 TU4E-(SS1)-3
A feasibility study of white light LEDs with omni-directional reflectors

Jung-Chieh Su, Jun-Ren Lo, Chung-Hsiang Lin, and Jim Y. Chi
Industrial Technology Research Institute, Taiwan

An experimental feasibility study of novel white light LED structure with omni-directional reflectors has been demonstrated. A comparison of the fluorescence with or without omni-directional reflector coating shows that the fluorescence intensity from the phosphor grain layer has been enhanced significantly.....

17:15-17:30 TU4E-(SS1)-4
Luminescence efficiency of InGaN-based multiple quantum well UV-LEDS

Chang-Chi Pan, Chia-Ming Lee, Wen-Jay Hsu, Guan-Ting Chen, and Jen-Inn Chyi
National Central University, Taiwan

Luminescence efficiency of ultraviolet light-emitting diodes (UV-LEDs) is investigated using electroluminescence measurements. The effects of thermal and layer structure on the external quantum efficiency at different current densities are discussed and clarified.

TH4B · Quantum Dot Physics and Devices (II) --- continued

17:00-17:15 TH4B-(SS2)-2
CW lasing of self-assembled InAs quantum dot lasers on GaAs substrates grown by metalorganic chemical vapor deposition

Jun Tatebayashi, Hideo Kakuma, Nobuaki Hatori, Mitsuru Ishida, Hiroji Ebe, Hisao Sudo, Akito Kuramata, Yoshiaki Nakata, Mitsuru Sugawara, and Yasuhiko Arakawa
RCAST&IIS NCRC; University of Tokyo; Fujitsu Laboratory, Japan

We report the fabrication of self-assembled InAs quantum dot lasers on GaAs substrates grown by metalorganic chemical vapor deposition. Continuous-wave lasing at room temperature with low threshold current (6.7 mA) has been achieved.

17:15-17:30 TH4B-(SS2)-3
Quantum dot structures and their optical properties of a high-indium InGaN film

Shih-Wei Feng, En-Chiang Lin, Yung-Chen Cheng, Hsiang-Chen Wang, C. C. Yang, Kung-Jen Ma, Cheng-Hsing Shen, L. C. Chen, K. H. Kim, J. Y. Lin, and H. X. Jiang
National Taiwan University; Chung Hua University, Taiwan; Kansas State University, USA

Yellow luminescence from an InGaN film of high indium content shifted into blue emission upon thermal annealing. The shift was attributed to the quantum dot-like cluster size reduction through spinodal decomposition at thermal annealing.

Auditorium ← (10F)

TU4C · Photonic Crystal and Devices for Communications
--- continued

17:30-17:45 TU4C-(16)-5

A channel drop filter in a two-dimensional triangular photonic crystal

*Min Qiu and Bozena Jaskorzynska
Royal Institute of Technology,
Sweden*

A design of a channel drop filter in a two-dimensional photonic crystal with a triangular lattice of air holes is presented, where no additionally incorporated materials and no extra small feature size are needed.

17:45-18:00 TU4C-(16)-6

Photonic crystal k-vector superprism

*Takashi Matsumoto and Toshihiko Baba
Yokohama National University,
Japan*

We propose a new photonic crystal superprism named "k-vector prism", in which a peculiar k-vector characteristic is utilized. High resolution and drastic miniaturization in a WDM filter will be possible, compared with the conventional superprism.

08:30-10:00

W1C · Near Field Spectroscopy and Luminescence in Photonic Crystals and Related Materials
T. Baba, Yokohama National University, Japan, Presider

**08:30-09:00 W1C-(16)-1
(Invited)**

Optical near-field microscopy of photonic crystals

*Vahid Sandoghdar
ETH Zurich, Switzerland*

09:00-09:15 W1C-(16)-2

Purcell effect in a microdisk laser at room temperature

*Daisuke Sano and Toshihiko Baba
Yokohama National University,
Japan*

We evaluated the Purcell factor in a

Room 107 ← (10F)

TU4E · Solid-State Lighting (II)
--- continued

17:30-17:45 TU4E-(SS1)-5

Effects on emission properties of interface thin layers in InGaN/GaN quantum well structures

*Yung-Chen Cheng, Horng-Shyang Chen, C. C. Yang, Zhe-Chuang Feng, and Gang Alan Li
National Taiwan University; LED Expert Corporation, Taiwan*

We report the variations of optical characteristics in InGaN/GaN quantum well samples with different thin layer (about 1 nm) structures between the wells and barriers, including silicon-doped InN and InGaN compounds.

Ever Green Room ← (10F)

TH4B · Quantum Dot Physics and Devices (II) --- continued

17:30-17:45 TH4B-(SS2)-4

Strain-induced material intermixing in multiple-stacked Ge/Si quantum dots grown by chemical vapor deposition

*Wen-Hao Chang, Wen-Yen Chen, An-Tai Chou, Tzu-Min Hsu, Pan-Shiu Chen, Zingway Pei, and Li-Shyue Lai
National Central University; ITRI, Taiwan*

Photoluminescence investigations on stacked Ge/Si quantum dots with different thicknesses of Si spacer layer are presented. According to the emission energy shift in the Ge dots, we found that thinner spacer will lead to remarkable Ge-Si intermixing.....

08:30-10:00

F1C · Metallic and Dielectric Photonic Crystals
Yean-Woei Kiang, National Taiwan University, Taiwan, Presider

**08:30-09:00 F1C-(16)-1
(Invited)**

Plasmonic photonic crystals: theory and experiment

*D. S. Kim
Seoul National University, Korea*

09:00-09:15 F1C-(16)-2

Polarization dependence of light intensity distribution from nanometer metallic slits

C. H. Wei, Wunshain Fann, P. K. Wei, Jonas O. Tegenfeldt, and Robert H. Austin

2.6- μm -diameter GaInAsP microdisk laser to be 6.7 through the measurement of cw lasing characteristics and the spontaneous emission lifetime. This is the first estimation at room temperature.

**09:15-09:30 W1C-(16)-3
Electroluminescence from
Ag-treated porous silicon
templates**

*Sven Heisig and Ryutaro Maeda
National Institute of Advanced
Industrial Science and Technology,
Japan*

We present a method to improve and stabilize electroluminescence from porous silicon. The electrical breakdown power increases by a factor of more than 25. The electroluminescence intensity is about 30 times higher compared to untreated samples.

W1C · Near Field Spectroscopy
and Luminescence in Photonic
Crystals and Related Materials
--- continued

**09:30-09:45 W1C-(16)-4
Isotropic photonic band gap in
2-d photonic microcavity with
Penrose quasicrystal pattern**

*Jia-yi Zhang, H. L. Tam, W. H.
Wong, Y. B. Pun, and K. W. Cheah
Hong Kong Baptist University; City
University of Hong Kong, Hong
Kong*

Isotropic photonic band gap is found to exist in photonic microcavity with Penrose quasicrystal pattern with 10-fold symmetry

**09:45-10:00 W1C-(16)-5
Edge diffraction induced
near-field contrast in
subwavelength structures**

*Hsieh-Li Chou, Yi-Chun Chen, and
Pei-Kuen Wei
Academia Sinica, Taiwan*

Optical near-field in subwavelength air-dielectric structure is studied by a collection-mode near-field optical microscopy. Concentrated optical near-field and large polarization anisotropy at the dielectric regions are measured. From the simulation of finite-difference time-domain method.....

*National Taiwan University;
Academia Sinica, Taiwan ;
Princeton University, USA*

The distribution of light intensity as a function of polarization in both the near and far-fields for single slits with widths below and above half a wavelength was studied both experimentally and by computer simulation.

**09:15-09:30 F1C-(16)-3
Dispersive QPM-SHG from $\chi^{(2)}$
nonlinear photonic crystal of
LiNbO₃ with tetragonal symmetry**

*C. -C. Hsu, Y. -C. Shih, and L. -H.
Peng*

National Taiwan University, Taiwan
We observe space dispersive, second harmonic green generations from a 2D QPM-periodically poled LiNbO₃ pumped by a Nd:YAG laser. The angular-tuning and phase-matching temperature analyses reveals a simultaneous quasi-phase-matching mechanism up to five reciprocal lattice vectors.....

F1C · Metallic and Dielectric
Photonic Crystals --- continued

**09:30-09:45 F1C-(16)-4
PBG structure of
two-dimensional magnetic
photonic crystals**

*Yun-Song Zhou, Ben-Yuan Gu, and
Fu-He Wang
Normal University; Chinese
Academy of Sciences, China*

Band gap structures of magnetic photonic crystals (PC's) are studied with the use of plane-wave expansion method. They strongly depend on the parameters of structures. The introduction of magnetic materials into PC diversifies the species of PC's.

**09:45-10:00 F1C-(16)-5
Disorder effects on negative
refractive lens made by photonic
crystals**

*Bikash Gupta and Zhen Ye
National Central University, Taiwan*

By a multiple scattering theory, we confirm that properly arranged photonic crystals can indeed act as a negative refractive lens. The tolerance of the lens to positional disorders is also discussed.

Auditorium -- (10F)

10:30-12:30
 W2C · Crystal Lasers and
 Related Devices
 Yong Hee Lee, Korea Advanced
 Institute of Science and
 Technology, Korea, Presider

10:30-11:00 W2C-(16)-1
 (Invited)
**Lasing action in organic
 photonic crystal and
 quasicrystal**
Masaya Notomi
 NTT, Japan

W2C · Crystal Lasers and
 Related Devices --- continued

11:00-11:15 W2C-(16)-2
**Continuous wave operation of
 surface-emitting
 two-dimensional photonic
 crystal laser**
D. Ohnishi, K. Sakai, and S. Noda
 Kyoto University; ROHM
 Corporation Limited; Japan
 Science and Technology
 Corporation, Japan
 We report continuous wave operation of
 a surface-emitting two-dimensional
 photonic crystal laser. The threshold
 current is as low as 40 mA, and a very
 narrow divergence angle (1.0°) is
 observed.

11:15-11:30 W2C-(16)-3
**Lasing characteristics of
 two-dimensional photonic
 crystal slab lasers with a
 modified linear shaped
 donor-type point defect**
*Masayuki Fujita, Yoshihiro
 Akahane, Atsushi Sugitatsu,
 Takashi Asano, and Susumu Noda*
 Kyoto University; Sumitomo
 Electric Industries, Ltd.; Mitsubishi
 Electric Corporation, Japan
 We developed two-dimensional
 photonic crystal slab laser with a
 modified linear shaped donor-type point
 defect for ultrahigh Q cavity. A device
 characteristic is found to be
 dramatically improved by the
 modification of the defect structure.

W2C · Crystal Lasers and
 Related Devices --- continued

11:30-11:45 W2C-(16)-4

Room 107 -- (10F)**EverGreen Room -- (10F)**

10:30-12:45
 F2C · Organic Light Emitting
 Diodes
 H. S. Kwok, The Hong Kong
 University of Science &
 Technology, Hong Kong,
 Presider

10:30-11:00 F2C-(17)-1
 (Invited)
**Printing of nanothick organic
 layers for photonic and
 photovoltaic devices**
*G. E. Jabbour and N.
 Peyghambarian*
 University of Arizona, USA

F2C · Organic Light Emitting
 Diodes --- continued

11:00-11:30 F2C-(17)-2
 (Invited)
**White organic light-emitting
 diodes operated by organic
 field-effect transistors**
*Hye Yong Chu, Seong Hyun Kim,
 Jeong-Ik Lee, Jung Hun Lee, Sang
 Chul Lim, Lee-Mi Do, and
 Taehyoung Zyung*
 Electronics and
 Telecommunications Research
 Institute, Korea
 Organic and/or polymer light-emitting
 diode (OLED) is one of the most
 promising candidates for the application
 in the future flat and flexible displays. In
 this presentation, fabrication methods
 and performances of the white...

F2C · Organic Light Emitting
 Diodes --- continued

11:30-11:45 F2C-(17)-3

Lasing characteristics and mode control of photonic crystal lasers with point and line composite defect

*Kyoji Inoshita and Toshihiko Baba
Yokohama National University,
Japan*

We observed the room temperature photopumped lasing in photonic crystal lasers with point defects and with point and line composite defects. We also demonstrate various resonant modes and the mode control by composite defects.

11:45-12:00 W2C-(16)-5

Ultralow threshold microgear lasers and their fusion with quasiperiodic photonic crystals

*K. Nozaki, A. Nakagawa, D. Sano,
and T. Baba*

*Yokohama National University,
Japan*

We demonstrate a GaInAsP microgear laser with the lowest record threshold of 11 μ W. We also propose the fusion of a microgear and a quasiperiodic photonic crystal for high Q and smaller mode volume.

W2C · Crystal Lasers and Related Devices --- continued

12:00-12:15 W2C-(16)-6

Photonic molecules by coupled microdisk lasers

Atsuo Nakagawa and Toshihiko Baba

*Yokohama National University,
Japan*

We fabricated a photonic molecule of two coupled microdisks, and observed the lasing with a photon coupling characteristic consistent with the theory. Such a molecule will provide a functional element such as a bistable device.

12:15-12:30 W2C-(16)-7

A novel white light LED structure using omnidirectional one-dimensional photonic crystals

*Chung-Hsiang Lin, Jung-Chieh Su,
and Jim Y. Chi*

*Industrial Technology Research
Institute, Taiwan*

We theoretically demonstrate a white light LED structure containing a one-dimensional photonic crystal which

Emission characteristics of white light phosphor

K. M. Lee, Bao-li An, Meng-lian Gong, Ying-liang Liu, and K. W. Cheah

Hong Kong Baptist University; Sun Yat-Sen University; Hong Kong; Jinan University, China

White light LED was successfully fabricated by converting near-UV LED emission (390-420nm) with a new white light phosphor. This new white phosphor was consisted of three fluorescence materials; two strontium aluminates based with lanthanide oxides, SrAl₂O₄.....

11:45-12:00 F2C-(17)-4

The study of blue organic light emitting diodes with a CUPC electron transporting layer

*Chih-Chih Lin, Mou-Zhong Lin,
Shui-Hsiang Su, and Meiso Yokoyama*

I-Shou University, Taiwan

Organic light emitting diodes using cooper phthalocyanine (CuPc), instead of tris-(8-hydroxquinoline) aluminum (Alq), as an electron transporting layer are fabricated. The outcome significantly results in the reduction of operating voltages.....

F2C · Organic Light Emitting Diodes --- continued

12:00-12:15 F2C-(17)-5

Highly efficient blue OLEDs using Ter(9,9-diarylfuorene)s with ambipolar carrier transport properties

*Y. -T. Lin, T. -L. Liu, W. -Y. Hung,
P. -Y. Hsieh, C. -C. Wu, and K. -T. Wong*

National Taiwan University, Taiwan

We report a highly efficient blue heterostructure organic light-emitting devices based on fluorene-based conjugated oligomers as the hole emitting layer. The amorphous thin films of ter(9,9-diarylfuorene)s exhibit non-dispersive bipolar transport and high carriers.....

12:15-12:30 F2C-(17)-6

Light emission in phase separated conjugated and non-conjugated polymer blends

Shen-Yi Hsu, Hsieh-Li Chou, and Pei-Kuen Wei

Academia Sinica, Taiwan
Phase separations in conjugated polymer (MEH-PPV) and non-conjugated polymer (PMMA) are studied by a near-field scanning microscopy and spectroscopy. Micron scale binary decomposition without

is designed by realistic fabrication parameters for the formation of omnidirectional photonic band gaps. With a band gap around 370 nm.....

photoluminescence spectrum shift occurs when the blending ratio (MEH-PPV/PMMA) is larger than one.....

F2C · Organic Light Emitting Diodes --- continued

12:30-12:45 F2C-(17)-7

A novel optical touch switch structure

Sarun Sumriddetchkajorn and Ratthasart Amarit

National Electronics and Computer Technology Center, National Science and Technology

Development Agency, Ministry of Science and Technology, Thailand

This paper proposes for the first time a novel optical touch switch structure based on the use of light total internal reflection (TIR) concept. Key features include ease of implementation, prevention of the light beam incident.....

5. 第一階段講員及授課摘要

A. Prof. H. S. Kwok

Centre for Display Research, Hong Kong University of Science and Technology, Hong Kong

- ✔ Silicon Microdisplay Technologies
- ✔ LCOS Optical Modes
- ✔ Projection Applications: Optical Elements
- ✔ Near Eye Applications: Color Scheme
- ✔ LCOS Business

B. Dr. Guo-Dung Su

Umachines, Inc., USA

- ✔ Micromachining Fabrication Process
- ✔ MEMS Physics and CAD Tools
- ✔ Optical MEMS Projection Display
 - Scanner
 - Grating Light Valve
 - Digital Light Processing
 - 3D Display

C. Prof. Ghassan E. Jabbour

Optical Sciences Center, The University of Arizona, USA

- ▼ Historical background
- ▼ Basic physical and chemical principles
- ▼ Chemicals used
- ▼ Device and material operational principles
- ▼ Polymer and molecular OLEDs
- ▼ Electrodes and interfaces
- ▼ Displays and related issues
- ▼ Fabrication tools
- ▼ Printing and patterning techniques in OLED fabrication
- ▼ Encapsulation
- ▼ Causes of degradation
- ▼ Future applications

D. Dr. T. Takebe

Sumitomo Electric, Japan

- ▼ ZnSe and Related Materials
- ▼ ZnSe Substrate for Homoepitaxial Growth
- ▼ Development of ZnSe-based White LEDs

E. Prof. Ian T. Ferguson

School of Electrical and Computer Engineering, Georgia Institute of Technology, USA

- ▼ Defining lighting terms
- ▼ CIE chromaticity diagram
- ▼ Basics of illumination design
- ▼ Current lighting technology
- ▼ LED principle
- ▼ LED fabrication technology
- ▼ LEDs for lighting applications
- ▼ Technical issues for adoption of LEDs for general illumination
- ▼ Current and future uses of SSL
- ▼ Application to liquid crystal display

6. 第二階段受邀講者及講題 (摘要詳第 4 點)

Eli Yablonovitch, UCLA, USA [Tutorial Lecture]

(TU3C, Tuesday 14:00-15:00 December 16)

"Photonic Crystals - New Materials for 21st Century"

Thomas F. Krauss, University of St. Andrews, UK

(TU4C, Tuesday 16:00-16:30 December 16)

"Photonic crystal WDM components"

Susumu Noda, Kyoto University, Japan

(TU4C, Tuesday 16:30-17:00 December 16)

"Manipulation of Photons by Artificial Defects in Photonic Crystals"

- Vahid Sandoghdar, ETH Zurich, Switzerland**
(W1C, Wednesday 08:30-09:00 December 17)
"Optical near-field microscopy of photonic crystals"
- Masaya Notomi, NTT, Japan**
(W2C, Wednesday 10:30-11:00 December 17)
"Lasing Action in Organic Photonic Crystal and Quasicrystal"
- Yasuo Ohtera and Shojiro Kawakami, Tohoku University, Japan**
(TH2C, Thursday 10:30-11:00 December 18)
"Functional Optical Components Consisting of Heterostructured Photonic Crystals"
- J. G. Fleming, Sandia National Laboratory, USA**
(TH2C, Thursday 11:00-11:30 December 18)
"Photonic Lattices Fabrication Using Si Lithographic Processes"
- D. S. Kim, Seoul National University, Korea**
(F1C, Friday 08:30-09:00 December 19)
"Plasmonic photonic crystals: theory and experiment"
- H. S. Kwok, The Hong Kong University of Science & Technology, Hong Kong, China**
(TH4E, Thursday 16:00-16:30 December 18)
"Bistable Liquid Crystal Displays"
- ByoungHo Lee, Seoul National University, Korea**
(TH4E, Thursday 16:30-17:00 December 18)
"Design and analysis of gratings and diffractive optical elements for displays"
- G. E. Jabbour and N. Peyghambarian, University of Arizona, USA**
(F2C, Friday 10:30-11:00 December 19)
"Printing of Nanothick Organic Layers For Photonic and Photovoltaic Devices"
- Taehyoung Zyung, ETRI, Korea**
(F2C, Friday 11:00-11:30 December 19)
"White organic light-emitting diodes operated by organic field-effect transistors"
- T. Takebe, Sumitomo Electric, Japan**
(TU3E, Tuesday 14:00-14:30 December 16)
"ZnSe-based White LED"
- V. Haerle, OSRAM Opto Semiconductor, Germany**
(TU4E, Tuesday 16:00-16:30 December 16)
"GaN LEDs for Solid-state Lighting"
- J. T. Hsu, OES of ITRI, Taiwan**
(TU4E, Tuesday 16:30-17:00 December 16)
"New approach of efficiency enhancement on GaN LED devices"
- D. Huffaker, University of New Mexico, USA**
(TH2B, Thursday 10:30-11:00 December 18)
"Progress in MOCVD grown quantum dot lasers"
- G. Solomon, Stanford University, USA**
(TH2B, Thursday 11:00-11:30 December 18)
"Spontaneous Emission Properties Of Position-Controlled Quantum Dots in Microdisk Cavities"
- Y. Toda, Hokkaido University, Japan**
(TH2B, Thursday 11:30-12:00 December 18)
"Optical characterization of strong carrier-phonon interactions in single quantum dots"
- E. Yoon, Seoul National University, Korea**
(TH2B, Thursday 12:00-12:30 December 18)
"Growth and optical properties of GaN-based quantum dots"
- Y. Arakawa, University of Tokyo, Japan [Tutorial Lecture]**
(TH4B, Thursday 16:00-17:00 December 18)
"Growth and physics of quantum dots for optoelectronics applications"

7. 經費使用說明

(1) 原始申請經費表 (總計 140 萬元)

92.05.20

補助項目		申請金額	說 明
人事費		133,320	1. 工讀生 1 名，月支 16,805 元，共 4 個月 2. 臨時工讀生 42 人日
業 務 費	場地費	150,000	場地及相關設備之租用
	國際差旅費 (含 2 天生活費)	584,500	訪問學者旅費補助 (共 13 名): 韓國 2 名--機票 14,000 元 生活費 6,250 元/天×2 天 日本 3 名--機票 18,000 元 生活費 6,250 元/天×2 天 美國 6 名--機票 40,000 元 生活費 6,250 元/天×2 天 德國 2 名--機票 50,000 元 生活費 6,250 元/天×2 天
	鐘點費	138,320	1. 講員：8,640 元 (3 小時) 共 13 名 2. 主持人：2,000 元 (3 小時) 共 13 名
	印刷、裝訂	100,000	邀稿、海報宣傳刊物及講義等
	餐飲費	104,000	研討會期間茶水費用 (80 元/人×100 人×2×6.5 天)
	電腦耗材	79,000	
	文具	20,000	
	紙張	20,860	
	郵電費	20,000	
	國內差旅費	50,000	
合 計		1,400,000	

(2) 修正後經費使用表 (總計 100 萬元)

92.08.29

補助項目		申請金額	說 明
人事費		379,520	1. 學士級專任助理第二年 1 名，月支 30,400 元 (11.5 月計) 2. 雇主負擔之勞健保費共 29,920 元 (學士級專任助理第二年 2,992 元 × 10 月 × 1 名)
其 他 費 用	國際差旅費 (含 2 天生活費)	339,500	訪問學者旅費補助 (共 7 名): 韓國 1 名--機票 14,000 元 生活費 6,250 元/天 × 2 天 日本 1 名--機票 18,000 元 生活費 6,250 元/天 × 2 天 美國 3 名--機票 40,000 元 生活費 6,250 元/天 × 2 天 德國 2 名--機票 50,000 元 生活費 6,250 元/天 × 2 天
	印刷、裝訂	80,000	邀稿、海報宣傳刊物及講義等
	餐飲費	78,000	研討會期間茶水費用 (80 元/人 × 100 人 × 2 × 6.5 天)
	電腦耗材	40,000	
	文具	20,000	
	紙張	27,980	
	郵電費	15,000	
	國內差旅費	20,000	
合 計		1,000,000	

(3) 報名費實際收入狀況

因與 CLEO/PR 2003 相隔一天舉行，因此為鼓勵大家參加本研討會，提出優惠措施，只要有報名參加 CLEO/PR 2003 者即可免費參加本研討會，因此本研討會實際收入未如原計畫申請時預計之多，實際上總收入約新台幣 15,000 元(大多數為學生，一般人士均因參加 CLEO/PR 2003 而免繳)。

並且針對已繳交本研討會報名費之學員，允許其免費參加 CLEO/PR 2003 中顯示科技為主題之課程，因此只要您參加本次 2.5 天之研討會如同參加了一場絕無僅有(最多 6.5 天)之研討會。

(3) 國科會補助部份餘款繳回說明

有剩餘款項繳回之會計科目分別為人事費 (NT\$ 45,895) 及其他費用 (NT\$ 23)，總計 NT\$ 45,918。

因執行中途原聘僱之學士級專任助理離職，改聘五專級專任助理，因國科會規定不得將餘裕之薪資及雇主負擔之勞健保費流用至其他費用，因此必須繳回。

(5) 實際支出一覽表

93.05.31

支出項目		金額	說明
人事費		333,625	1. 學士級專任助理第二年 1 名，月支 30,400 元（92 年 8~12 月及年終獎金，共 6.5 個月），以及雇主負擔之勞健保費共 8,735 元，總計 206,335 元。 2. 五專級專任助理第一年 1 名，月支 23,200 元（93 年 1~5 月，共 5 個月），以及雇主負擔之勞健保費共 11,290 元，總計 127,290 元
其他費用	國際差旅費 ※ 提供生活費共 8 天（包含 CLEO/PR 2003 五天—此乃其來台之條件）	397,500	訪問學者旅費補助（共 5 名）： 香港 1 名--機票 9,500 元及生活費 6,250 元/天×8 天，共 59,500 元 日本 1 名--機票 18,000 元及生活費 6,250 元/天×8 天，共 68,000 元 美國 3 名--機票 40,000 元及生活費 6,250 元/天×8 天，共 90,000 元， 總計 270,000 元 （與其他補助 CLEO/PR 2003 之經費互相支援流用）
	印刷、裝訂	80,000	邀稿、海報宣傳刊物及講義等
	餐飲費	40,000	研討會期間茶水費用 （100 元/人×80 人×2×2.5 天）
	電腦耗材	40,000	
	文具	20,000	
	紙張	20,000	
	郵電費	20,000	
	其他雜項	17,957	
合計		969,082	國科會補助：1,000,000.- + 實收報名費：15,000.- - 國科會餘款繳回：45,918.- = 969,082.-

8. 來訪外國學者對此研討會之觀感：

本研討會之國外講員，除來自香港之郭海城教授及台灣出國留學之蘇國棟博士外，其餘都是第一次來台，他們對本研討會之觀感可歸納如下：

- (1) 我國對顯示科技發展之用心令人印象深刻，顯示科技及相關產業發展空間極大，對於前瞻性技術之特別關照，彰顯本研討會之用心良苦。
- (2) 此次人才培育研討會配合 CLEO/PR 2003 舉辦在策略上相當成功，若非有 CLEO/PR 2003 大型研討會舉行，學者可順道參加，否則，不易集結多方面具代表性之學者專家來從事人才培育工作。另外，參加人才培育之學員可免費參加 CLEO/PR 2003，更可擴展學員之視野。過去，台灣辦人才培育活動，多為應燃眉之急，如此具前瞻性之人才培育研討會並不多見。
- (3) 國外學者認為此種人才培育研討會還可擴大辦理，他們也推薦了一些國外相關領域之專家，以備下一次辦理。
- (4) 最後，他們對國內顯示科技產業之蓬勃發展，表示印象深刻。

9. 參加人才培育研討會學員獲益情況

- (1) 據瞭解，參加學員於聆聽五位學者之課程後，第一個感想即是，除了國內產業大量投資的液晶顯示外，原來顯示科技還有如此大的廣度與發展空間，希望國內不要因為目前液晶顯示獲利良好，而忽略了更大發展的機會。
- (2) 參加學員亦可免費參與 CLEO/PR 2003 之活動，讓他們有機會聽到許多來自世界各地知名專家學者之 invited papers 及 contributed papers，多表示興奮，此舉大大拓展他們的視野與胸襟。
- (3) 本人才培育研討會講者之講義整理相當好，而且願意公開，對學員助益極大。這些講義可以做為他們進一步研發的素材。

四、結論與建議

對我國影像顯示科技與產業之發展而言，本計畫乃一重要的嘗試。固然，目前我國在影像顯示產業乃以液晶顯示為主，百分之九十以上的產值都在此，然而，技術仍在快速發展中，液晶顯示技術如何發展，而液晶技術又能存活多久，從前瞻發展的角度看，都是未知數。因此，本計畫執行乃從前瞻的角度著手，所邀請來之國外學者都是針對影像顯示技術較前衛的發展來探討相關技術，相信對國內相關學者及工程人員啟發不小。

茲有下列幾項建議：

- (一) 液晶顯示公司所需人才種類多，在培育人才的努力上宜廣視角來看，不要只著重液晶。
- (二) 人才不足乃暫時性的現象，切勿在培育人才上矯枉過正，仍應循正規教育發展，教育尤應注意前瞻性。
- (三) 國外有許多在顯示科技發展上極有創意的看法，應多引進，不能只執著於從日本抄來的技術。即如在日本發展出來的實用技術，最初創意的源頭也多是在美國，我們宜廣為吸收創意，發展出超越日本的技術。