國立臺東大學 理工學院
NATIONAL TAITUNG UNIVERSITY COLLEGE of SCIENCE and ENGINEERING

教師指導學生專題製作與論文競賽補助 成果報告

一、 申請補助計畫基本資料

申請教師	黃俊元	核定經費	7000
單位系所	應用科學系	經費執行情況	■已請購核銷完畢 □尚未請購核銷 □經費餘款_____
計畫執行年度/學期	113 年度第一學期	參賽期程	113 年 11 月 27 日~ 113 年 11 月 28 日
參加競賽/學術活動名稱	Optics & Photonics Taiwan International Conference (OPTIC 2024)	作品名稱	**Low-Roughness Patterned Silver Nanowire Electrodes for Quantum Dot Light-Emitting Diodes**
指導參賽學生姓名	林俊廷、李季皓、簡翊倫	班級	碩一、應科四、應科三
競賽性質	■國際性 □校際	參賽地點	台北南港展覽館
系所主管簽章		日期	
學院院長簽章		日期	

二、 參賽作品：(論文摘要或作品說明)

Title: Low-Roughness Patterned Silver Nanowire Electrodes for Quantum Dot Light-Emitting Diodes

Silver nanowires (AgNWs) possess excellent conductivity and flexibility, making them ideal materials for flexible electronic devices. However, their high surface roughness can negatively impact device performance. To address this issue, the roughness of the composite electrode was reduced to 10.3 nm using a transparent photopolymer, achieving a sheet resistance of 7~9 Ω/sq. This electrode was applied as the anode in quantum dot light-emitting diodes (QLEDs), resulting in a turn-on voltage of 2.4 V, a maximum brightness of 72,922 cd/m², and a current efficiency of 27.8 cd/A.

三、 參加之競賽活動：(請依據參加活動次數，依序附上相關活動簡章或海報、議程與參加證明等佐證資料)

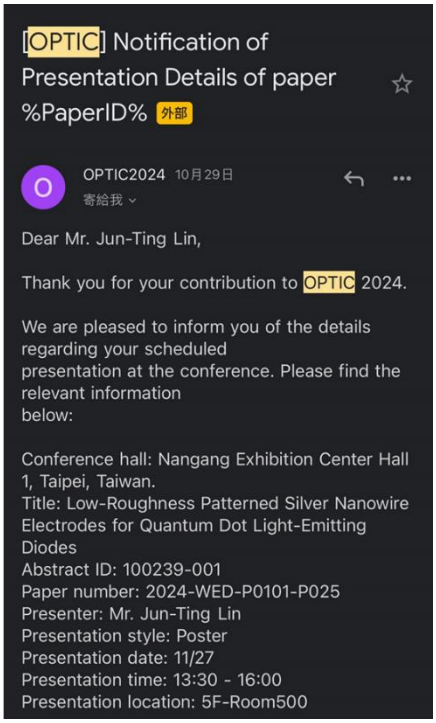
Notification of Accepted Abstract
OPTIC 2024, November 26 - 29

Dear Mr. Jun-Ting Lin,

Thank you for submitting your abstract for OPTIC 2024, taking place at Nangang Exhibition Ceter Hall 1 in Taipei from November 26-29. We are pleased to inform you that your abstract has been accepted for presentation.

The Program Committee has scheduled your abstract as follows:

Abstract ID: 100239-001
Abstract Title: Low-Roughness Patterned Silver Nanowire Electrodes for Quantum Dot Light-Emitting Diodes
Authors(s): Jun-Ting Lin, Tsai-Ti Tung, Jun-Feng Hou, Chun-Yuan Huang
Presentation Type: Poster
Session Title: Nanophotonic Materials and Devices
Student Award Candidate: no



[OPTIC] Notification of Presentation Details of paper %PaperID% 外部

OPTIC2024 10月29日
寄給我

Dear Mr. Jun-Ting Lin,

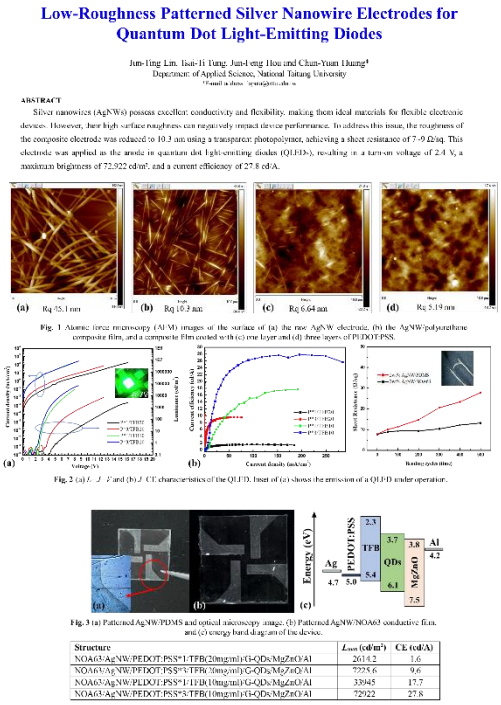
Thank you for your contribution to OPTIC 2024.

We are pleased to inform you of the details regarding your scheduled presentation at the conference. Please find the relevant information below:

Conference hall: Nangang Exhibition Center Hall 1, Taipei, Taiwan.
Title: Low-Roughness Patterned Silver Nanowire Electrodes for Quantum Dot Light-Emitting Diodes
Abstract ID: 100239-001
Paper number: 2024-WED-P0101-P025
Presenter: Mr. Jun-Ting Lin
Presentation style: Poster
Presentation date: 11/27
Presentation time: 13:30 - 16:00
Presentation location: 5F-Room500

四、參賽準備與活動記錄

※請附文字說明與 4-6 張活動照片（無照片則免附）



Low-Roughness Patterned Silver Nanowire Electrodes for Quantum Dot Light-Emitting Diodes

Jun-Ting Lin, Tsai-Ti Tung, Jun-Leng Hou and Chun-Yuan Huang*
Department of Applied Science, National Taitung University

ABSTRACT

Silver nanowires (AgNWs) possess excellent conductivity and flexibility, making them ideal materials for flexible electronic devices. However, their high surface roughness can negatively impact device performance. To address this issue, the roughness of the composite electrode was reduced to 10.3 nm using a transparent photopolymer, achieving a sheet resistance of 7–9 Ω/sq. This electrode was applied as the anode in quantum dot light-emitting diodes (QLED-), resulting in a turn-on voltage of 2.4 V, a maximum brightness of 72,922 cd/m², and a current efficiency of 27.8 cd/A.

(a) Rq 55.1 nm (b) Rq 10.3 nm (c) Rq 6.64 nm (d) Rq 3.19 nm

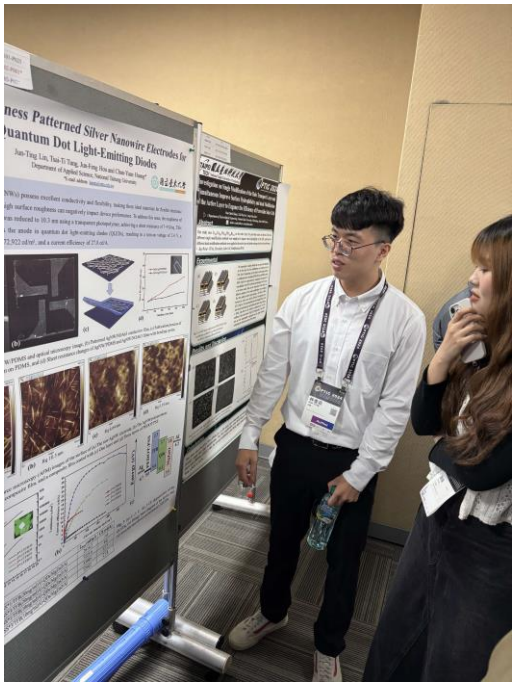
Fig. 1 Atomic force microscopy (AFM) images of the surface of (a) the raw AgNW electrode, (b) the AgNW/polyurethane composite film, and a composite film coated with (c) one layer and (d) three layers of PEDOT:PSS.

Fig. 2 (a) J–V and (b) L–CE characteristics of the QLED. Inset of (a) shows the emission of a QLED under operation.

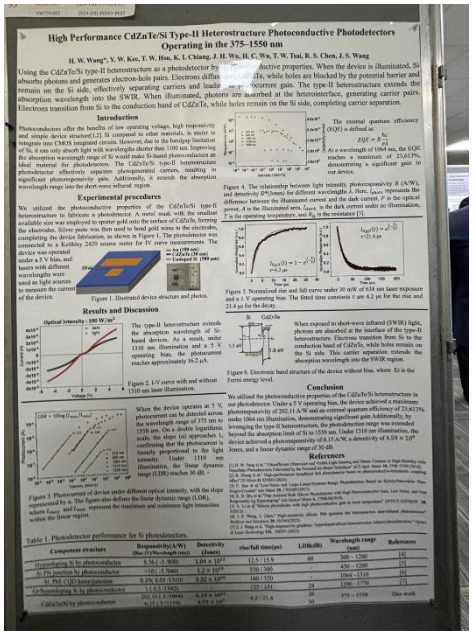
Fig. 3 (a) Patterned AgNW/PDMS and optical microscopy image, (b) Patterned AgNW/NOA63 conductive film, and (c) energy band diagram of the device.

Structure	L_{max} (cd/m²)	CE (cd/A)
NOA63/AgNW/PEDOT:PSS*1/TFB(20mg/ml)/G-QDs/MgZnO/Al	2614.2	1.6
NOA63/AgNW/PEDOT:PSS*1/TFB(30mg/ml)/G-QDs/MgZnO/Al	7225.6	9.6
NOA63/AgNW/PEDOT:PSS*1/TFB(10mg/ml)/G-QDs/MgZnO/Al	33945	17.7
NOA63/AgNW/PEDOT:PSS*3/TFB(10mg/ml)/G-QDs/MgZnO/Al	72922	27.8

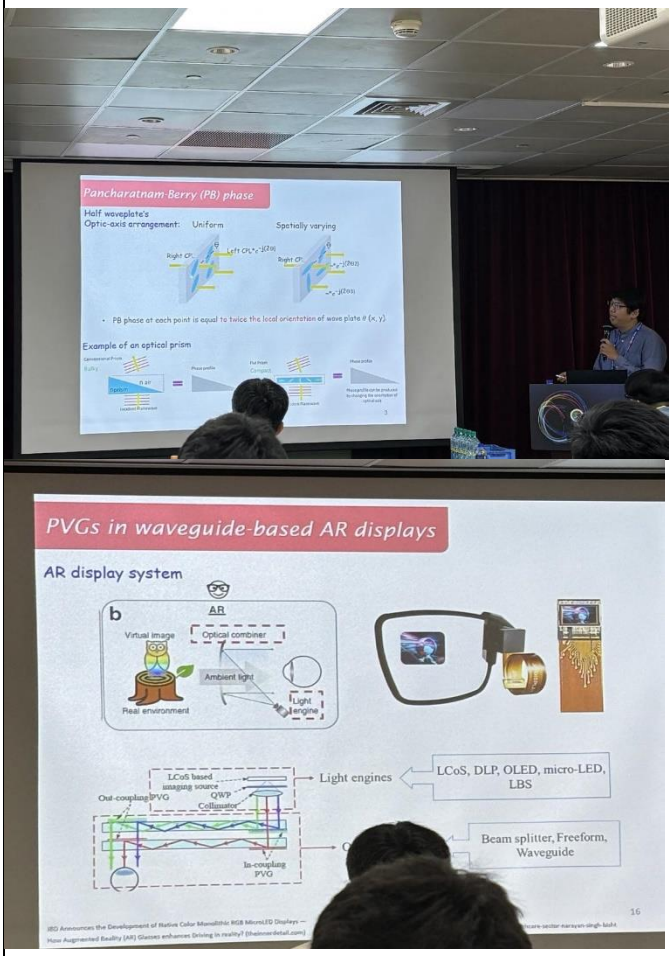
圖說明：將銀奈米線應用於量子點發光二極體，探索其在透明導電薄膜中的性能優化，並將研究成果整合成海報展示。



圖說明：將研究海報與其他學校交流，分享彼此在實驗中遇到的問題、解決方法及心得，促進技術合作與經驗交流，共同提升實驗效率與研究成果。



圖說明：與其他學校的海報交流中，了解到 CdZnTe/Si 異質結構光檢測器具備高光響應增益，能將矽的吸收範圍拓展至短波紅外區域，同時展現低操作電壓與簡單結構的成像優勢，讓人增廣見聞。



圖說明：聽了其他學校老師介紹液晶技術及未來潛力，在不同電場作用下液晶的排列變化，並在光的偏振、折射和反射等方面的應用。這項技術未來能廣泛應用於 AR 顯示器及濾光器等領域。

五、參加競賽成果 (參賽證明、得獎證明或學生心得)

參加 2024 OPTIC 大會後，我深刻體會到自己是非常幸運的，因為學校的實驗室設備相當完善，而有些學校可能只能進行模擬，甚至需要依賴其他學校協助製作實體樣品。這次經驗讓我了解到光電的應用範圍極其廣泛，不僅局限於顯示器或 LED，還涵蓋了許多其他領域。此外，我也結交了許多志同道合的朋友，讓我更加確信在光電這條道路上並不孤單。透過這次在 2024 OPTIC 的交流，我更加相信未來在學術領域上，自己一定能持續進步，邁向更高的成就。