出國報告（出國類別：其他）

參加 2016 年主動式矩陣顯示元件國際研討會出國報告

服務機關：核能研究所
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摘 要

2016 年主動式矩陣顯示元件國際研討會(AM-FPD”16)會議主題以光電產業技術為主。此會議為日本光電業者每年一度最重要的會議之一，會中所發表之論文與論壇主題每年隨著世界上最新技術及應用發展更新，並提供最新的研發訊息。而在 2016 年本次會議主要兩個研發重點領域為透明氧化物薄膜材料的開發與應用以及近期熱門的鈣鈦礦薄膜太陽能電池材料及製程技術。其中，以電漿濺鍍方式製作之氧化物薄膜於半導體應用已趨近成熟，已陸續應用於現有的消費型電子產品上，但製造成本依舊偏高且主要關鍵技術仍被日本顯示器大廠所掌握。而氧化物薄膜的研發主題後續除了朝更多應用領域拓展外，主要目標設定在可撓式基材上實現元件製作為主要研發領域，包含了濺鍍、塗佈及圖案化設備開發以及關鍵材料的開發等領域。而針對鈣鈦礦薄膜太陽能電池的研發領域，目前仍以小面積高效率方面有較佳的進展，但距離鈣鈦礦薄膜太陽能電池要能實際應用仍有許多瓶頸需要克服，例如長期的可靠度、大面積製作良率、無毒材料的取代以及材料理論基礎等皆需各國研發單位持續投入相關領域的開發。由於光電科技產業於製程及設備的使用上具有相當高的同質性，許多應用於光電科技產業電漿鍍膜製程設備與薄膜元件所使用之設備皆為同一家廠商所開發，包含大面積化均勻鍍膜及製程技術,於整體技術研發的藍圖上具有極高的一致性。藉由參與此技術研討會，發表電致變色研發成果論文與國內外光電領域專家及設備商進行交流獲得更多可撓式製程技術資訊及相關研究發展方向，並與各國頂尖專家交流加速本所在可撓式製程設備技術之開發。

此外,針對上述兩個研發領域的具體建議為透明半導體元件主流製程技術仍以電漿濺鍍技術為主，顯示電漿鍍膜製程技術仍為光電元件鍍膜發展主流，與本所目前電漿領域發展方向一致，雖然在顯示器領域已趨近成熟，在開發策略上可針對透明金屬氧化物特殊的材料特性,進行其它領域應用之先期開發研究，並憑藉著顯示器領域所帶動之設備迅速發展，有效縮短產品開發的量產期程。而鈣鈦礦型太陽能電池材料研發則為太陽能電池研發重點項目，主要藉由電漿電濺鍍、蒸鍍以及材料合成技術成膜，目前國外已有不錯的突破，建議可藉由國際合作方式加速本所在此領域的研發速度。

目　次

圖目錄

一、目　的

參加 2016 年主動式矩陣顯示元件國際研討會，發表電致變色元件研發成果論文，並搜集電漿鍍膜綠色節能相關技術暨設備應用之最新資訊，進而瞭解國際研發現況、市場及趨勢。2016 年主動式矩陣顯示元件國際研討會是由日本應用物理協會(Japan Society of Applied Physics)主辦，及國際知名研究協會 IEEE Electron Devices Society、ECS Electronics and Photonics Division 及 ECS Japan Section 所共同協助舉辦，本屆會議為第 23 屆，專題講座邀請來自德國、美國、韓國、日本、台灣等各國專家學者及光電產業界技術研發主管。

本次研討主題包括(1)平面顯示器及可撓式元件相關製程設備製程技術；(2)薄膜電晶體元件技術；(3)太陽能電池元件相關技術；(4)創新薄膜元件及材料製程技術等。

由於光電領域所使用之設備及相關元件開發有一定程度的同質性，因此藉由參加會議蒐集國際上相關研究主題可做為本所規劃後續研發方向之參考依據。本所電漿在綠色節能環境之開發與應用計畫是發展光伏及節能之薄膜元件製程和整合系統為主軸。希望藉由參與此研討會及發表論文，與來自世界各地的相關領域傑出的研究者及工業界人士互相交流汲取知識，以獲得更多電漿鍍膜綠色節能技術之資訊及相關發展方向，對本所技術之提升和創新有相當助益。

二、過　程

本次公差之行程如下：

7 月 5 日 10:10 自桃園國際機場出發，於當地時間 13:50 抵達大阪關西國際機場。從機場搭乘火車前往會議舉行地點京都，於 17:30 到達飯店辦理入住事宜。

7 月 6 日~7 月 8 日參加 2016 年主動式矩陣顯示元件國際研討會及發表電致變色元件研發成果論文，並蒐集資研發資料。

7 月 9 日 於當地時間 12:30 自飯店出發，搭乘火車前往大阪關西國際機場。15:30 抵達大阪關西國際機場，並於 19:05 自大阪關西國際機場出發前往桃園國際機場，抵達台灣時間為 21:05，順利完成本次公差任務。

三、心　得

AM-FPD”16 研討會為日本一年一度的光電技術研討會，為全球光電元件領域重要之會議之一，本屆會議為第 23 屆。本次會議有來自 10 個國家的 200 多名科學家、學校教授、研發單位、工業代表、政策決策者參與，研討會所發表之論文皆為目前最先進的光電及材料研發領域。

會議活動主要是以演講及論文海報的方式呈現，共計有 34 場演講以及 72 篇的論文海報發表，是光電研發產業重要的交流平台，有目前最新的研發技術及第一手的產業研發動態，會議大樓為位於京都車站附近的龍谷大學校友會館，現場如圖一所示。與會的人員以日本、韓國、台灣佔大多數，主要的原因為高科技的光電產業大多由日本、韓國、台灣為主，從另一個觀點來看亦是彼此間光電領域高科技競爭技術的展示。

圖一、AM-FPD”2016 研討會會場大樓

本次研討會有論文發表與海報展示，主要的論文發表以邀請相關領域的專家演講為主，，除了研發技術及能力的展示外，並包含以一些學術及研發單位的先進研發成果，其餘則從投稿的論文中挑選較新穎的論文為口頭發表的論文，會議時段從上午九點開始安排到下午五點。本次會議之主題分成四大類：(1) active-matrix flatpanel displays (AM-FPDs) ； (2) thin-film transistors (TFTs) ； (3) photovoltaics (PV) technologies ；(4) thin-film materials and devices (TFMD)。AM-FPD”2016會議的議程安排如圖二所示。

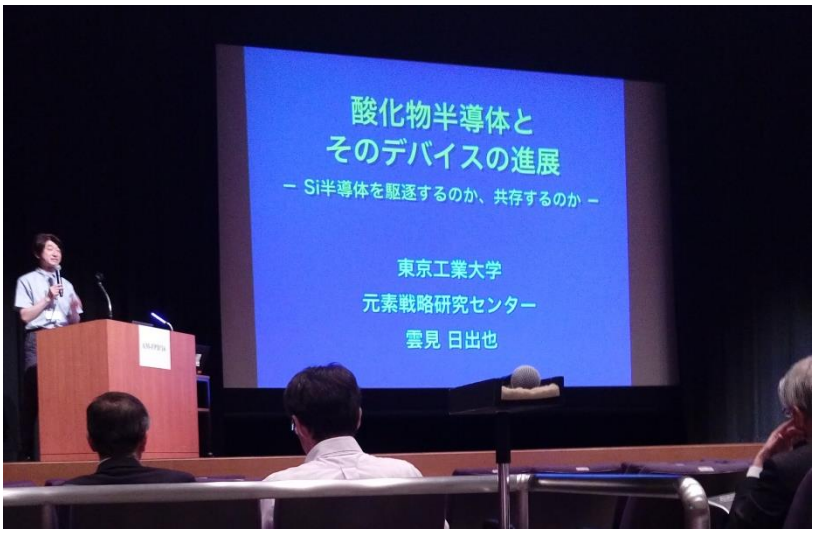
AM-FPD '16 Time Table

	Wednesday, July 6		Thursday, July 7		Friday, July 8	
Registration	9:30-17:00		9:15-17:00		9:15-14:00	
Tutorial	10:00-12:00	*Tutorial in Japanese*				
Workshop			9:15-10:45	**Symposium 1 :** Development and Future Innovation of TFT Technology	9:15-10:25	**Special Session :** New Driving Technologies
			10:45-11:00	*Coffee Break*	10:25-10:40	*Coffee Break*
			11:00-12:20	**Symposium 2 :** Thin-Film Materials for Sensing Devices	10:40-11:50	**Session 4 :** High-Performance TFTs
	12:00-13:00	*Lunch*	12:20-13:35	*Lunch*	11:50-13:00	*Lunch*
	13:00-13:15	Opening Session	13:35-15:05	**Symposium 3 :** Next-Generation Thin-Film Solar Cells	13:00-13:40	**Session 5 :** Perovskite Photovoltaics
	13:15-14:15	**Session 1 :** Keynote Address			13:40-14:20	**Session 6 :** Advanced Processing and Devices
	14:15-15:20	**Session 2 :** Novel Application of TFTs			14:20-14:35	*Coffee Break*
	15:20-15:35	*Coffee Break*			14:35-15:40	**Session 7 :** Basic Properties of Oxide TFTs
	15:35-16:45	**Session 3 :** Novel Application on Photovoltaics				
	16:45-17:15	Late News			15:40-15:45	Closing Remarks
Author Interviews	17:15-17:45	Author Interviews	15:05-15:35	Author Interviews	15:45-16:15	Author Interviews
Poster Session			15:35-18:00	**Poster Session :** FPDp / TFTp / TFMDp / PVp / LNp		
Banquet	18:00-20:00	*Banquet*				

Workshop : “Ryukoku University Avanti Kyoto Hall” (Avanti, 9th Floor)
Registration : Entrance (Avanti, 9th Floor)
Poster Session : Mariage Grande “Glove” (Avanti, 8th Floor)
Author Interviews : Lobby (Avanti, 9th Floor)
Banquet : Mariage Grande “Glove” (Avanti, 8th Floor)
Tutorial : “Ryukoku University Avanti Kyoto Hall” (Avanti, 9th Floor)

圖二、 研討會議時程表

本次會議主要以邀請演講論文為主，會議一開始的上午訓練課程即以透明氧化物半導體以及鈣鈦礦(Perovskite)薄膜太陽能電池的兩個演說拉開序幕，內容包含透明氧化物半導體及鈣鈦礦薄膜太陽光電元件研發現狀、原理、製作方式進行主題的簡介及演講，分別由東京工業大學的雲見教授以及東京工業近藤教授針對上述兩項材料相關主題進行簡介，如圖三及圖四所示。以下針對此會議演講內容重點摘要於本出國報告中提供研發參考。

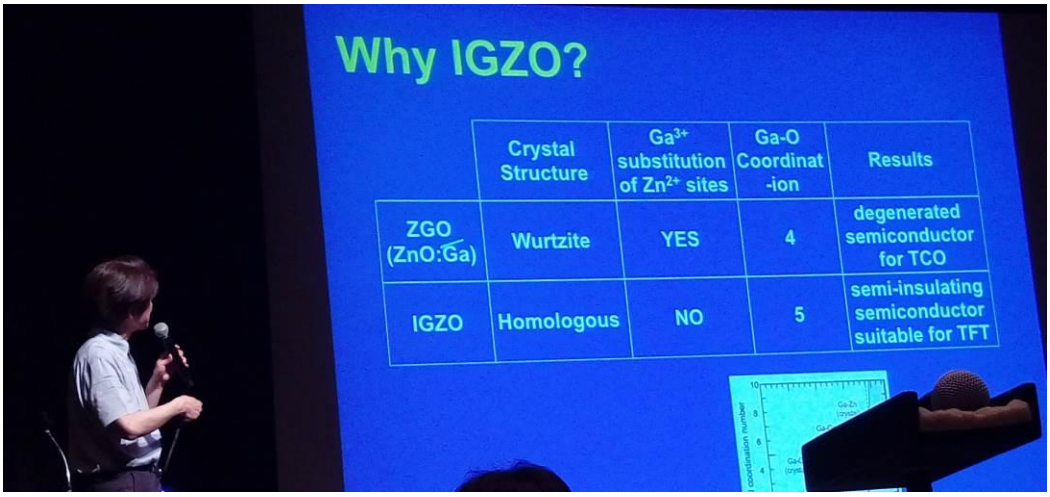


圖三、東京工業大學的雲見教授針對透明氧化物半導體材料進行簡介

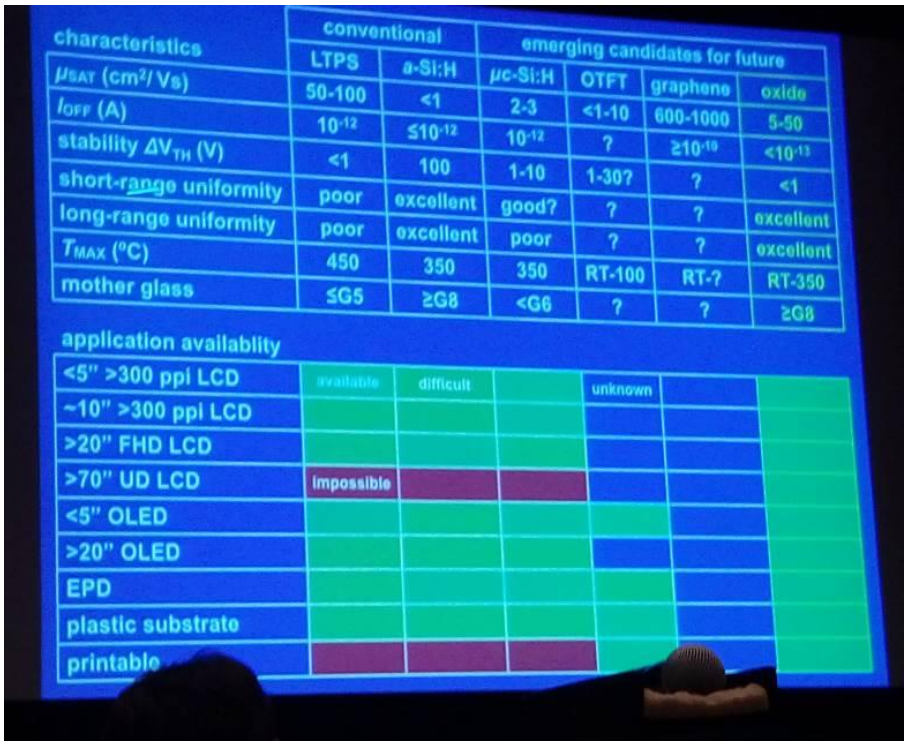
圖四、東京大學的近藤教授針對鈣鈦礦(Perovskite)薄膜太陽能電池材料進行簡介

針對透明氧化物半導體材料部分，藉由不同金屬氧化物材料結構的組成、金屬離子的取代、以及氧化物鍵結的價數等材料差異性，說明為何選用 IGZO(InGaZnO)的為半導體材料的主要原因，相關比較資訊列表如圖五所示。並針對目前市面上使用於顯示領域之半導體材料與透明氧化物半導體進行特性比較，說明透明氧化物半導體材料的優點以及可應用的尺寸及領域，包含現有的液晶顯示器、OLED 顯示器、電子紙(EPD)以及因應未來可撓式顯示應用所需的塑膠基板及噴印製造製程，透明氧化物半導體材料皆可符合需求，相關比較資訊列表如圖六所示。其中，對於非晶矽材料與非晶態的 IGZO 材料在半導體能隙(Energy Bandgap)中因缺陷密度分佈及密度較低，因此在載子傳輸機制方面有顯著的差異性，對於非晶矽材料的載子傳輸機制主要受限於能隙中較高的缺陷密度，主要的傳導機制為缺陷間的載子跳躍(Hopping)

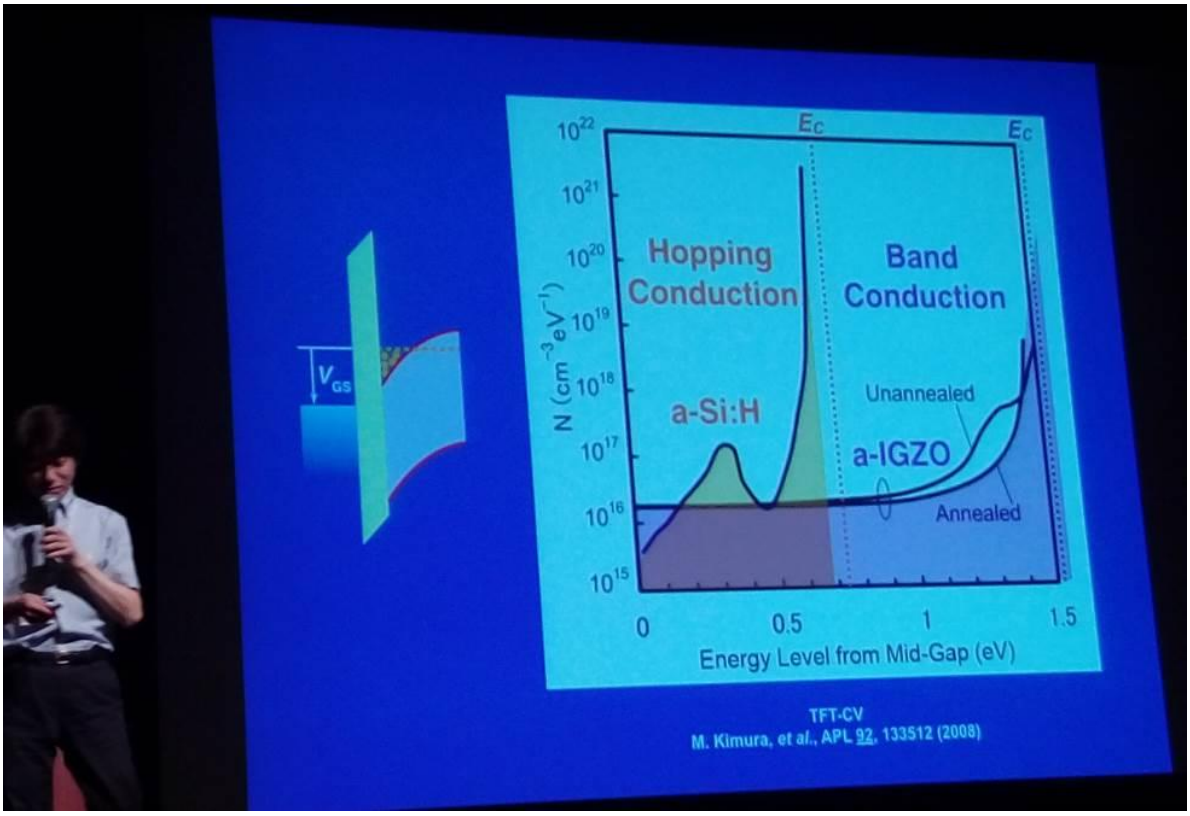
為主。而另一方面，非晶態的 IGZO 材料具有較低的缺陷密度，因此在載子傳輸機制方面由能帶(Energy Band)的傳輸機制主導，因此也造就了非晶態的 IGZO 材料較高的載子移動率(mobility)特性，如圖七所示。圖八為 2006 年時世界上第一個以電漿濺鍍製程製作出的非晶態 IGZO 薄膜電晶體元件橫切面圖及其電性列表。近幾年來，許多高階的消費性電子產品亦陸陸續續搭載了以非晶態 IGZO 薄膜為電晶體元件之顯示器，如圖九所示。而針對透明氧化物半導體材料及元件之研發，近年來世界各國亦有需多的研究單位及大廠投入了相關的研發工作，但整體而言日本相關的廠商及研發單位仍掌握了主要的關鍵技術，如圖十所示。最後，東京工業大學的雲見教授針對顯示器相關的應用提出目前透明金屬氧化物薄膜電晶體研發領域尚待解決之問題，提供研發單位參考，如圖十一所示。而金屬氧化物半導體材料的研發，後續仍可依不同的金屬氧化物材料光電特性發展更多的複合型應用，以及藉由跨國跨單位的合作研究加速金屬氧化物材料導入整體市場。



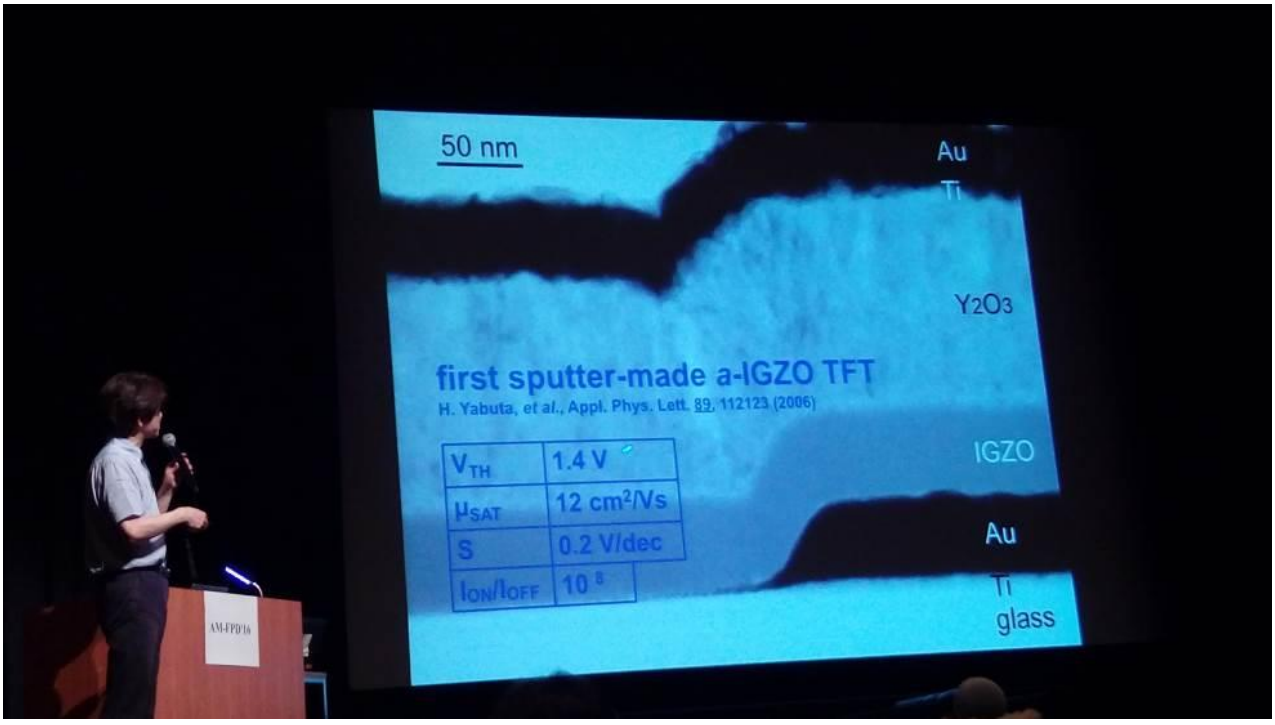
圖五、選用 IGZO(InGaZnO)為半導體材料的主要原因列表



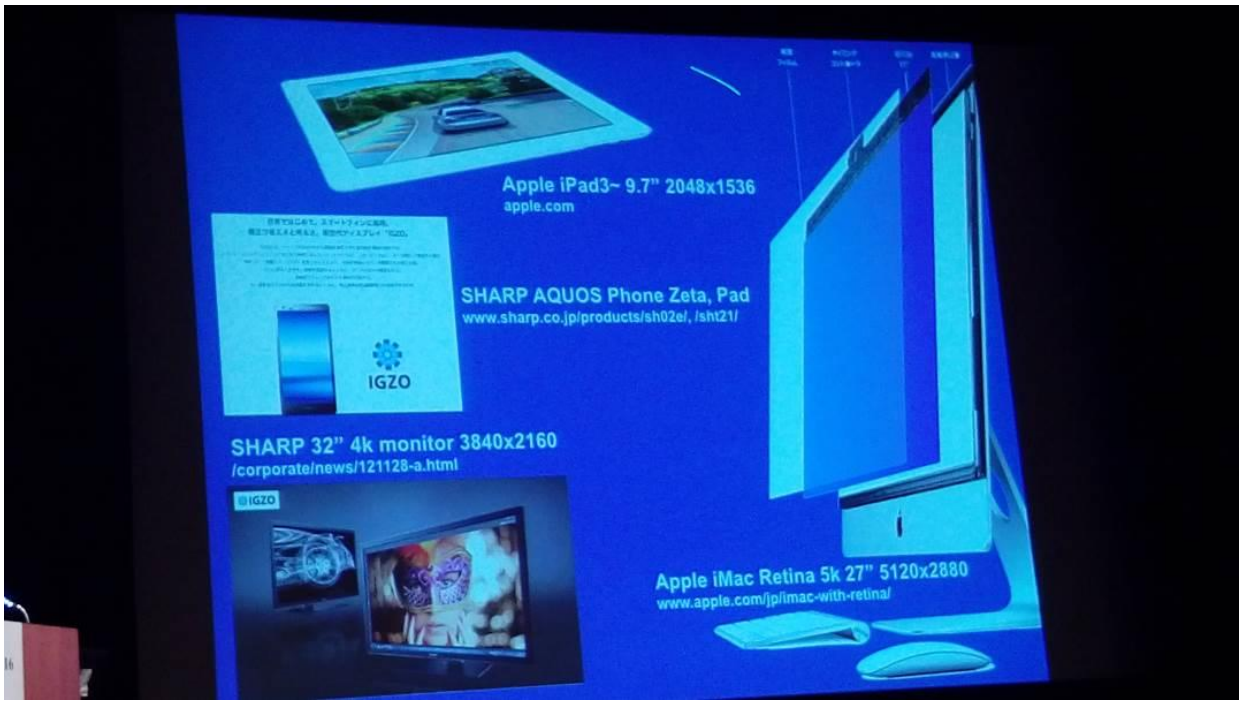
圖六、半導體材料與透明氧化物半導體特性比較列表



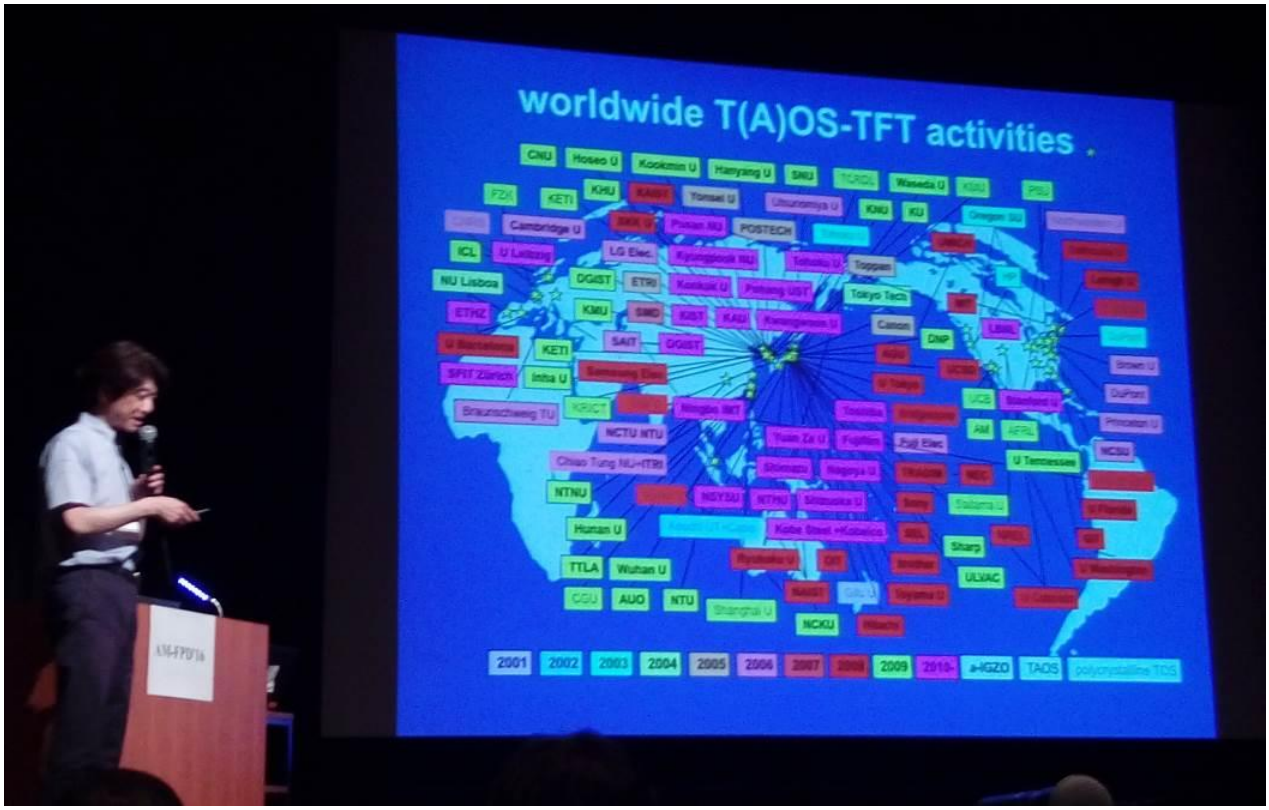
圖七、非晶矽材料與非晶態 IGZO 半導體材料能隙特性比較圖



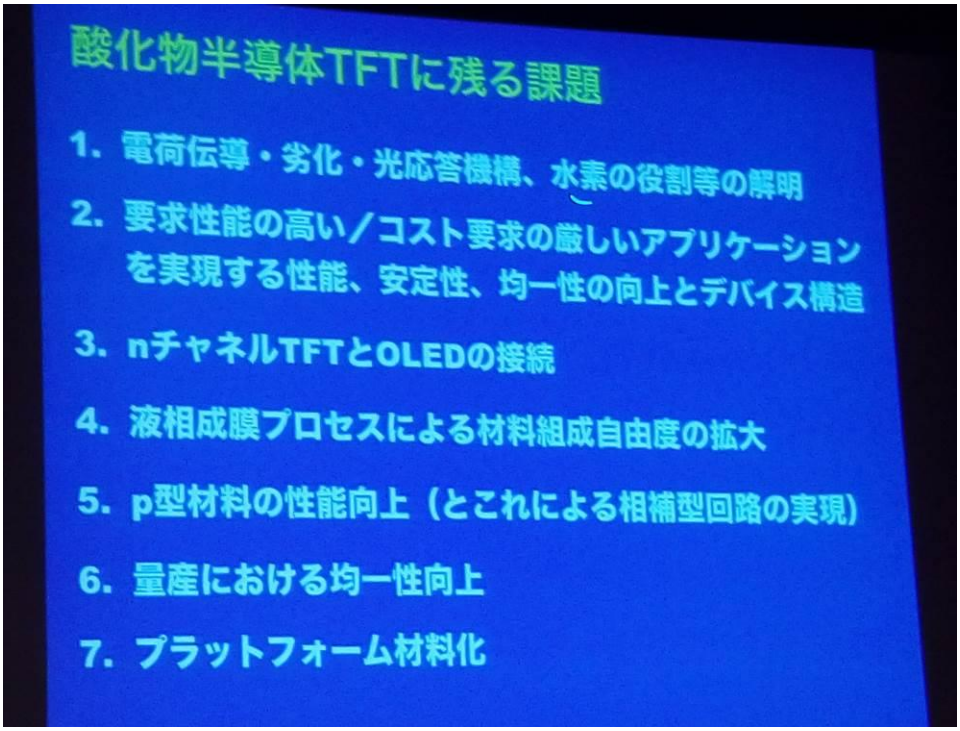
圖八、以電漿濺鍍製程製作非晶態 IGZO 薄膜電晶體元件之橫切面圖及其電特性



圖九、市售高階消費型電子產品陸續搭載以非晶態 IGZO 薄膜電晶體元件為基底之顯示器

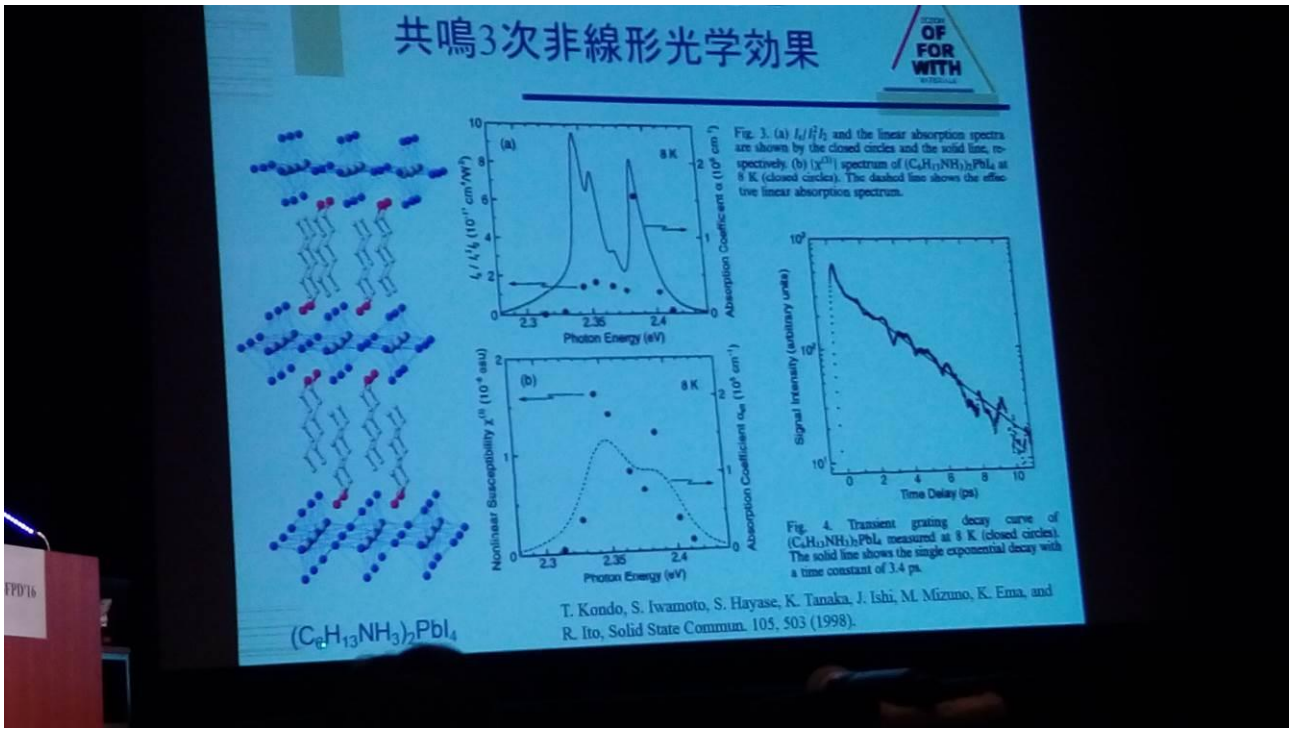


圖十、近年來世界投入金屬氧化物材料研發單位統計

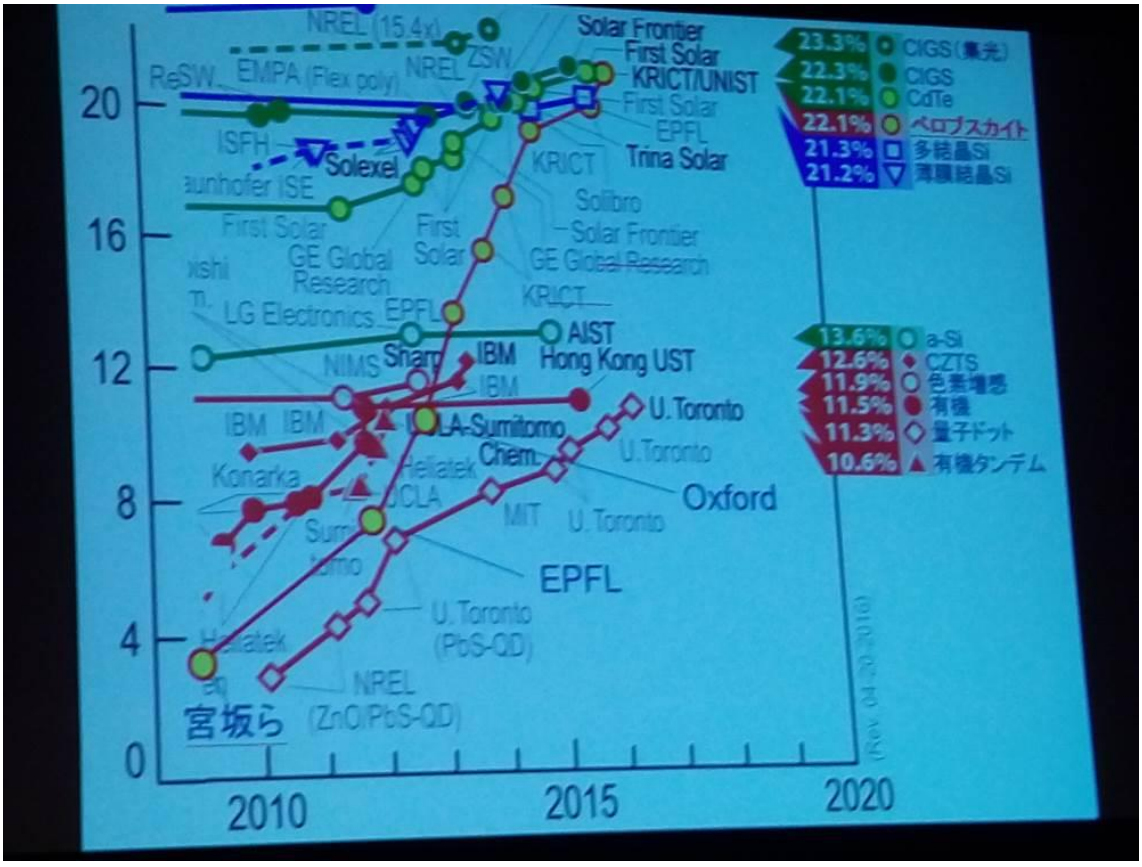


圖十一、透明金屬氧化物薄膜電晶體研發領域尚待解決之問題

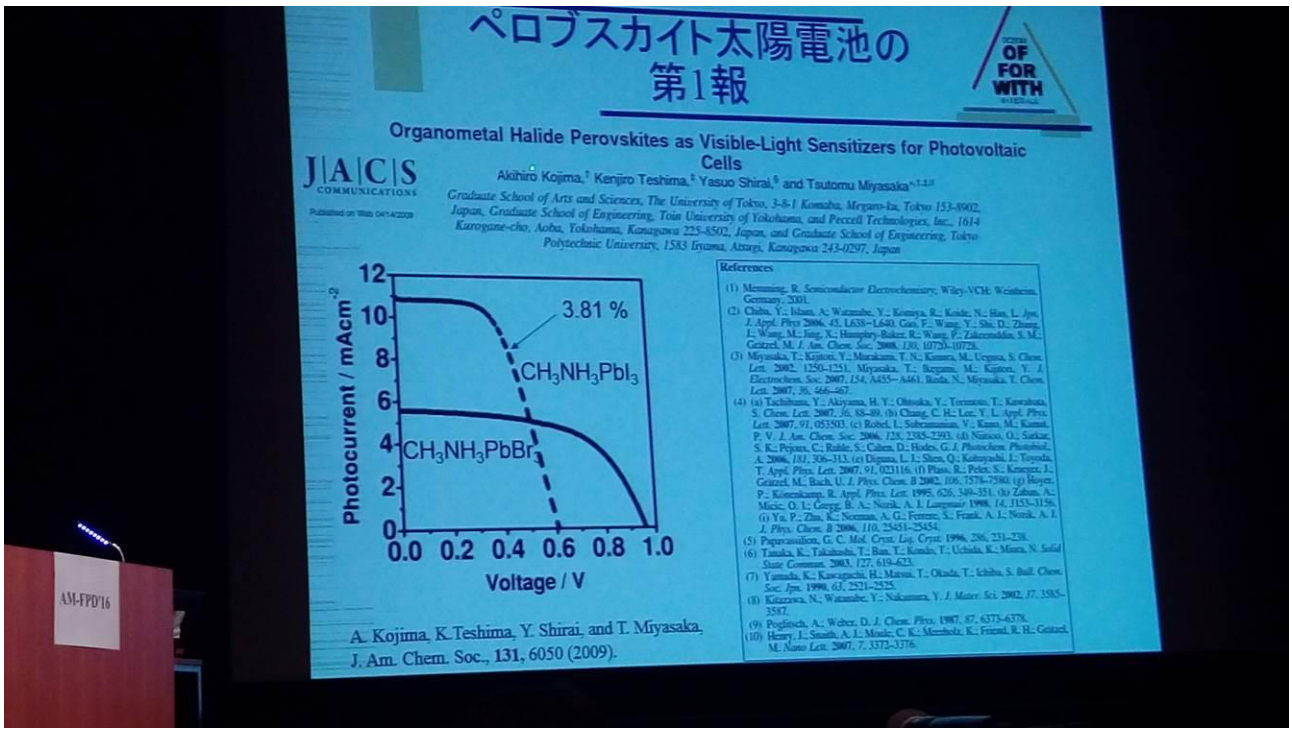
另一場演講由東京大學的近藤教授針對鈣鈦礦(Perovskite)薄膜太陽能電池材料進行簡介，由 III-V 族 GaAs/GaAsAl 材料組成具週期空間反轉結構的波長轉換材料概念介紹鈣鈦礦(Perovskite)薄膜為何具有吸收太陽光能轉換為電力的能力。其說明主要是由於鈣鈦礦材料如$(C_6H_{13}NH_3)_2PbI_2$結構具非線性光學共鳴的效應提供了吸收太陽光能的效應，並以共鳴 3 次的非線性光學效果舉例說明上述效應，如圖十二所示。而目前鈣鈦礦(Perovskite)薄膜太陽能電池的研發上，於 2016 年所發表之最高光電轉換效率已達 22.1%，如圖十三所示。圖十四為 2009 年世界上第一個發表鈣鈦礦(Perovskite)薄膜太陽能電池之文獻，光電轉換效率約為 3.81%。並在 2016 年藉由不同元素組成之鈣鈦礦(Perovskite)薄膜，成功的將太陽能電池的光電轉換效率一舉突破 20%，如圖十五所示。而如此高光電轉換效率的鈣鈦礦(Perovskite)薄膜太陽能電池在另一方面卻也具有與傳統太陽能電池不同的光電特性，如時十六所示，介面的缺陷以及薄膜本身的極化效應導致太陽能電池在連續兩次量測時光電特性曲線出現了不一致的現象，皆是亟待解決的問題。圖十七為基本的鈣鈦礦(Perovskite)薄膜太陽能電池元件結構橫切面圖，主要由 5 層薄膜組成，包含透明導電膜 SnO_2F (FTO)、電子型二氧化鈦半導體薄膜(TiO_2)、電洞型鈣鈦礦半導體薄膜(Perovskite)、電洞傳輸膜 Spiro-OMeTAD、以及導電金屬薄膜金(Au)。其結構又可細分為染料型、空隙顆粒型、以及平面異質接面型結構等元件樣式，如圖十八所示。若以材料的觀點來說，以鈣鈦礦結構組成之材料(ABX_3)在許多領域都曾發現其特性的光電特性，如鐵電特性、離子傳導特性、反磁特性以及超導特性等，如圖十九所示。因此，在太陽能電池領域應用為鈣鈦礦薄膜材料近年來的創新發現。此外，鈣鈦礦半導體薄膜在材料本身可藉由不同元素材料的混合組成，調變半導體材料的能隙達成吸收不同波段光能的特性也為薄膜太陽能電池的高效率化提供了更多的可能性，如圖二十所示。



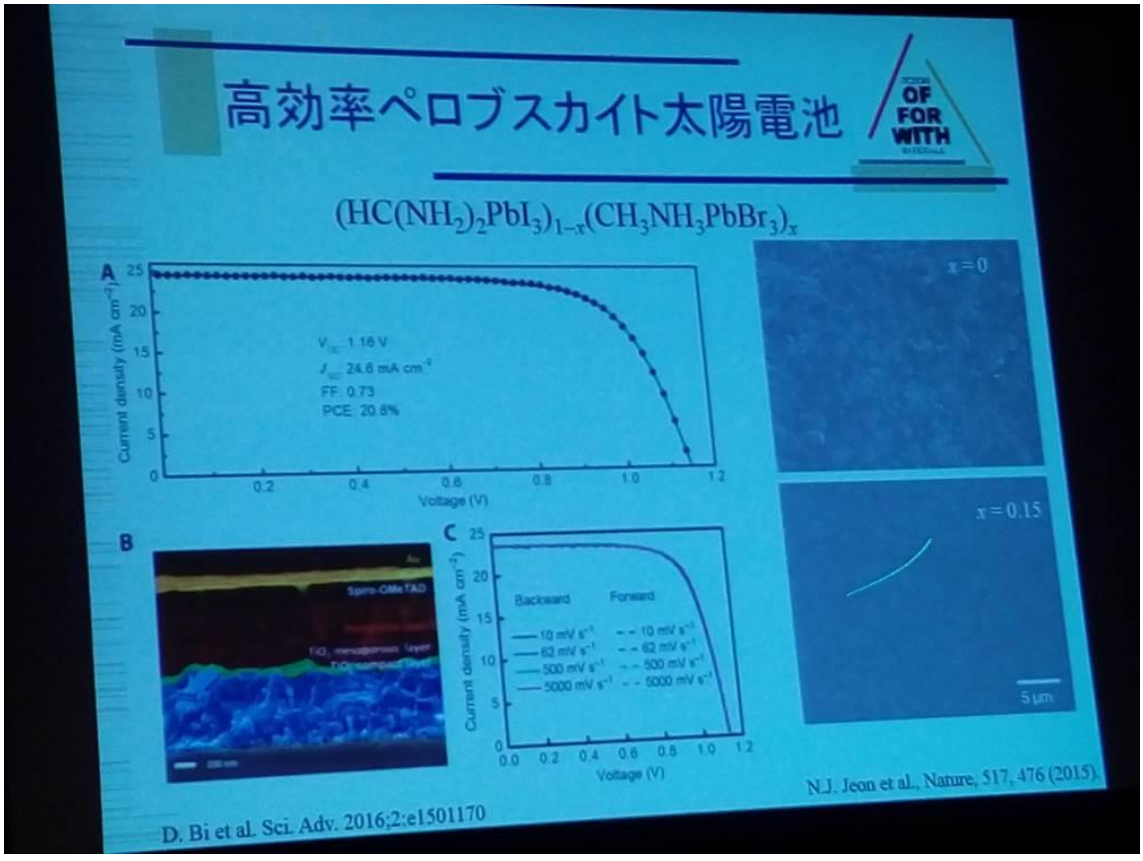
圖十二、鈣鈦礦材料 $(C_6H_{13}NH_3)_2PbI_2$ 結構共鳴 3 次的非線性光學效果



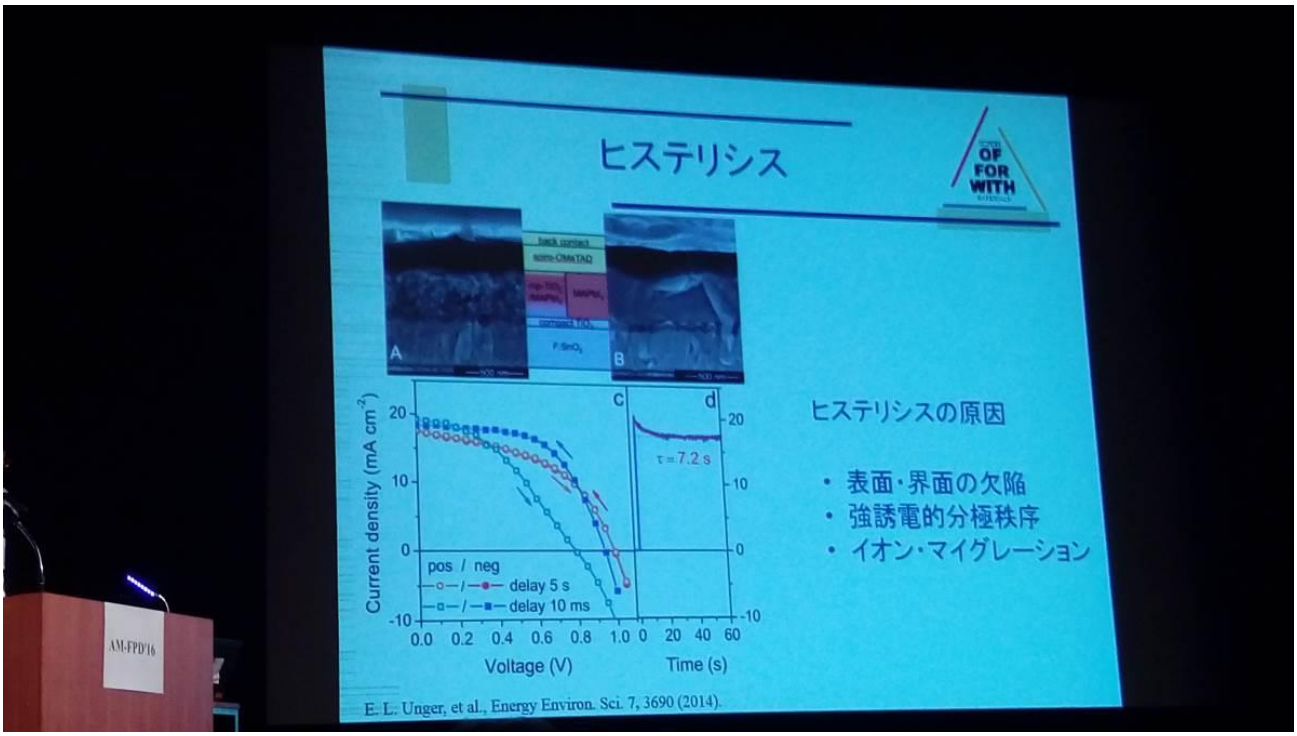
圖十三、鈣鈦礦薄膜太陽能電池於 2016 年所發表之最高光電轉換效率已達 22.1%



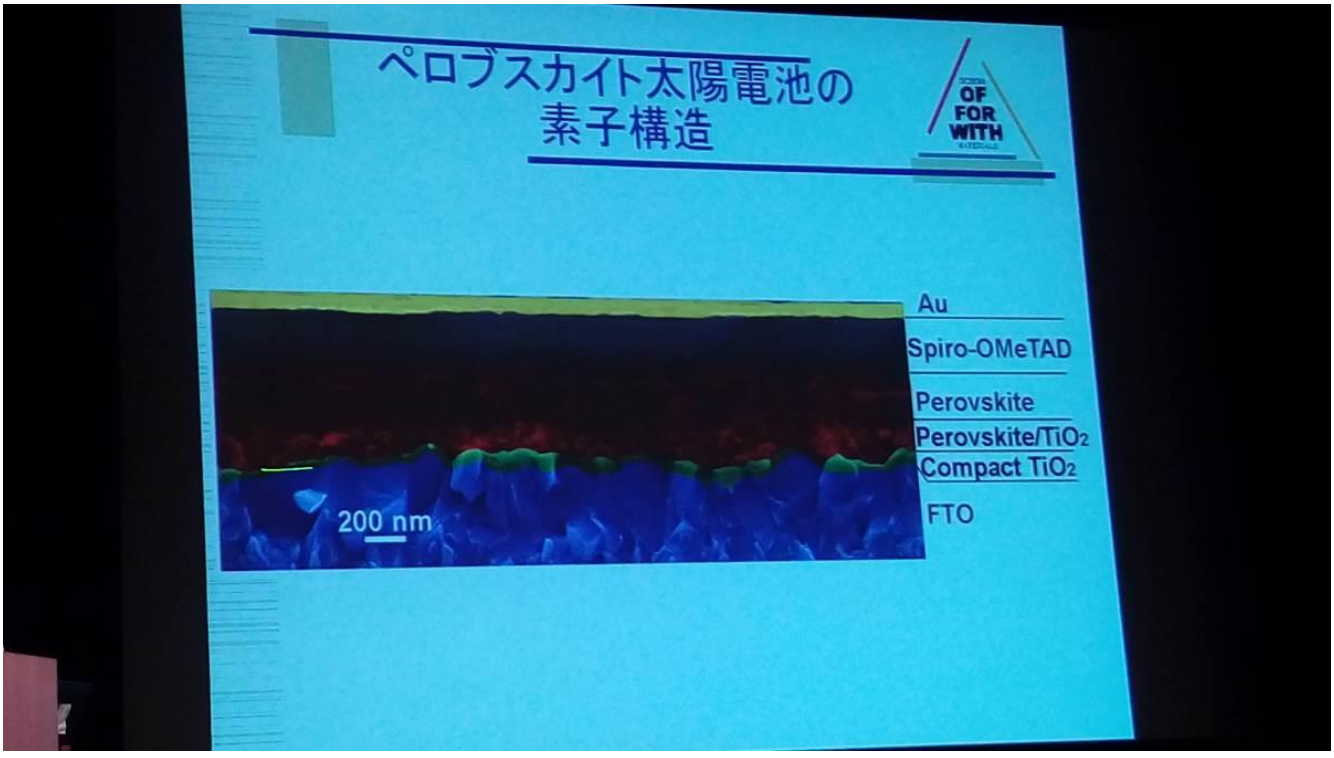
圖十四、世界上第一個發表鈣鈦礦(Perovskite)薄膜太陽能電池之文獻



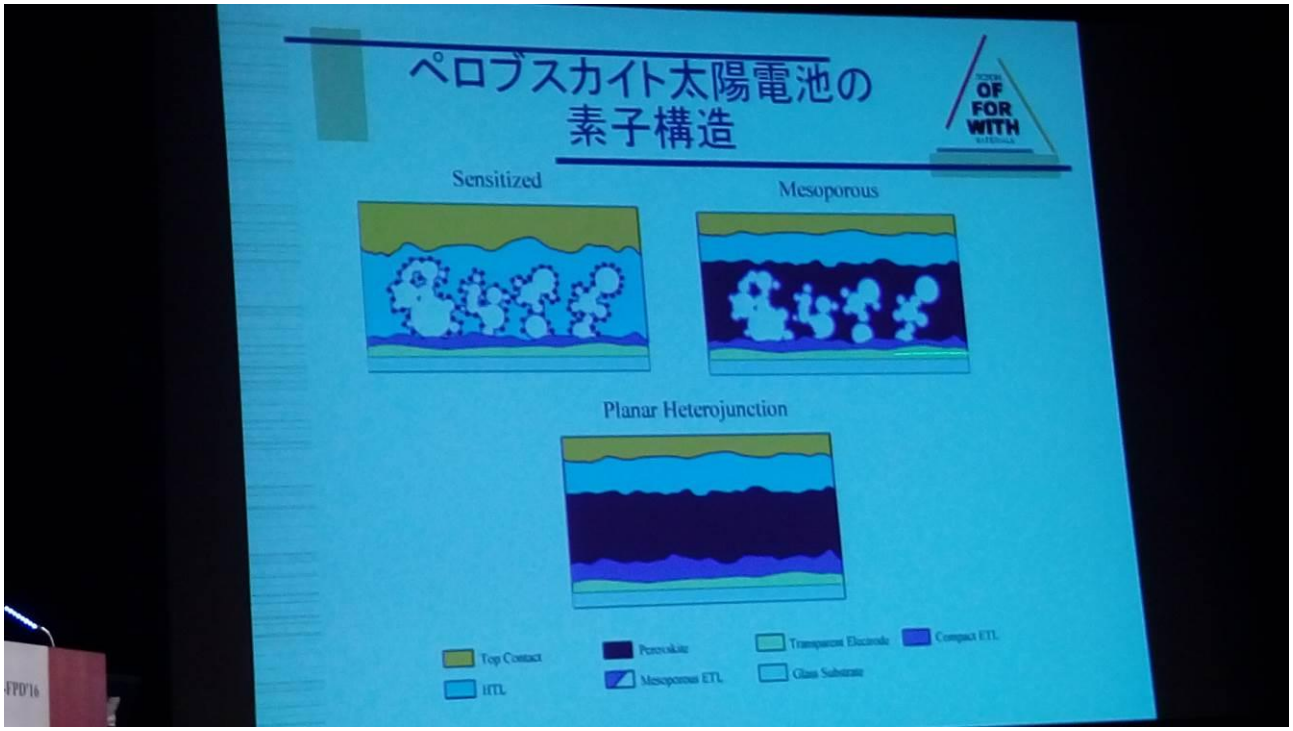
圖十五、藉由不同元素組成之鈣鈦礦(Perovskite)薄膜提升光電轉換效率 20%以上



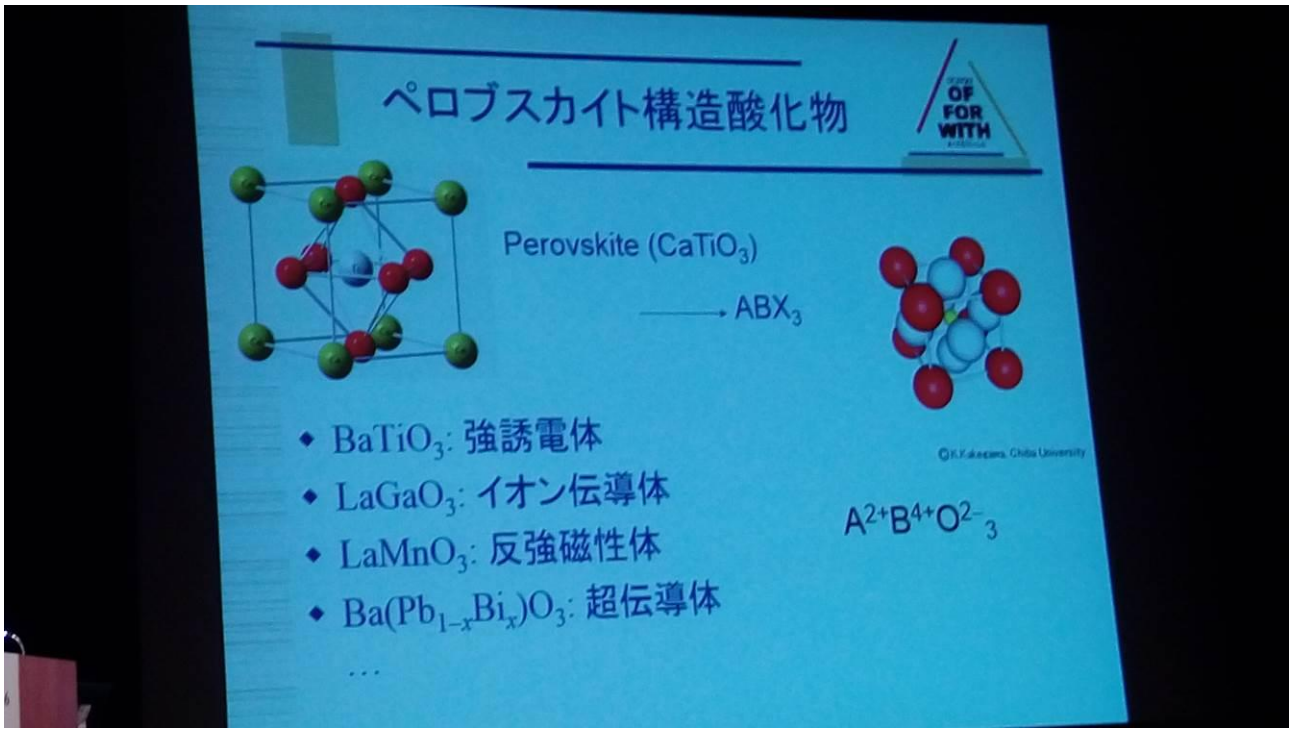
圖十六、鈣鈦礦(Perovskite)薄膜太陽能電池因介面缺陷及薄膜極化導致光電特性曲線不一致



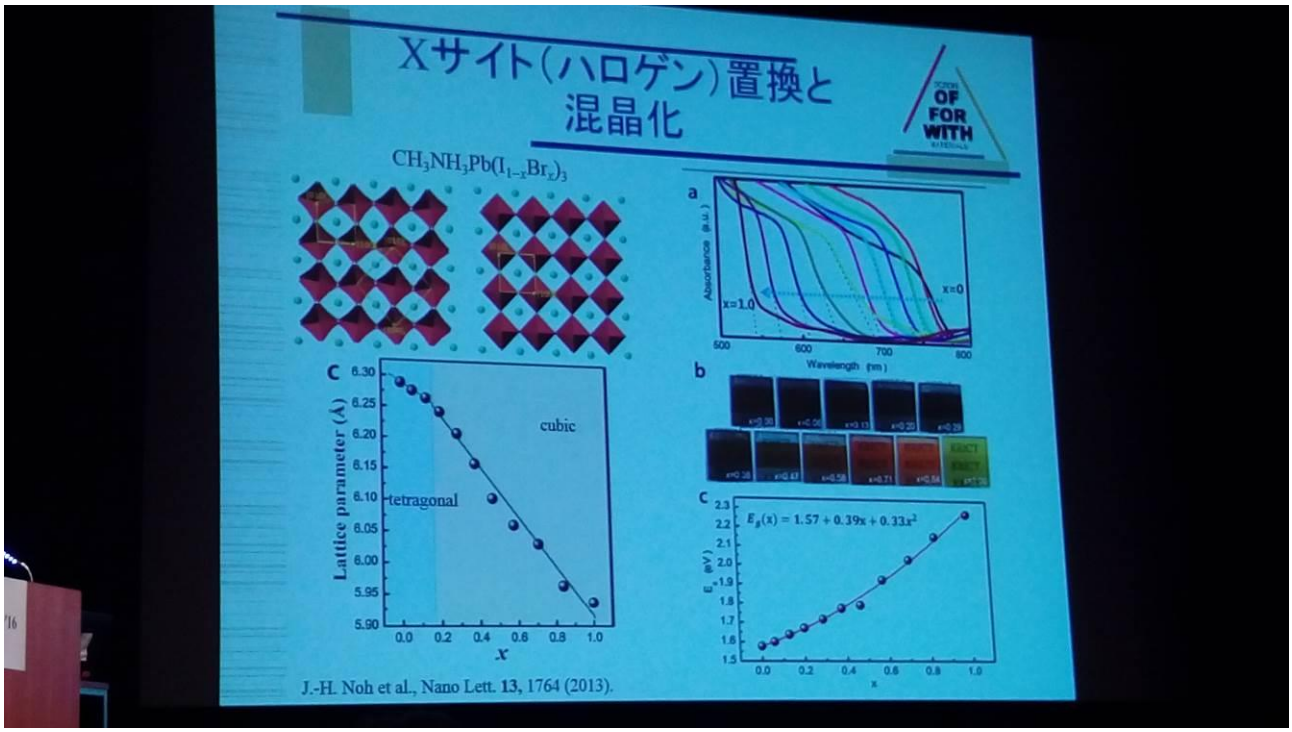
圖十七、鈣鈦礦(Perovskite)薄膜太陽能電池元件結構



圖十八、染料型、空隙顆粒型、以及平面異質接面型之鈣鈦礦薄膜太陽能電池元件結構

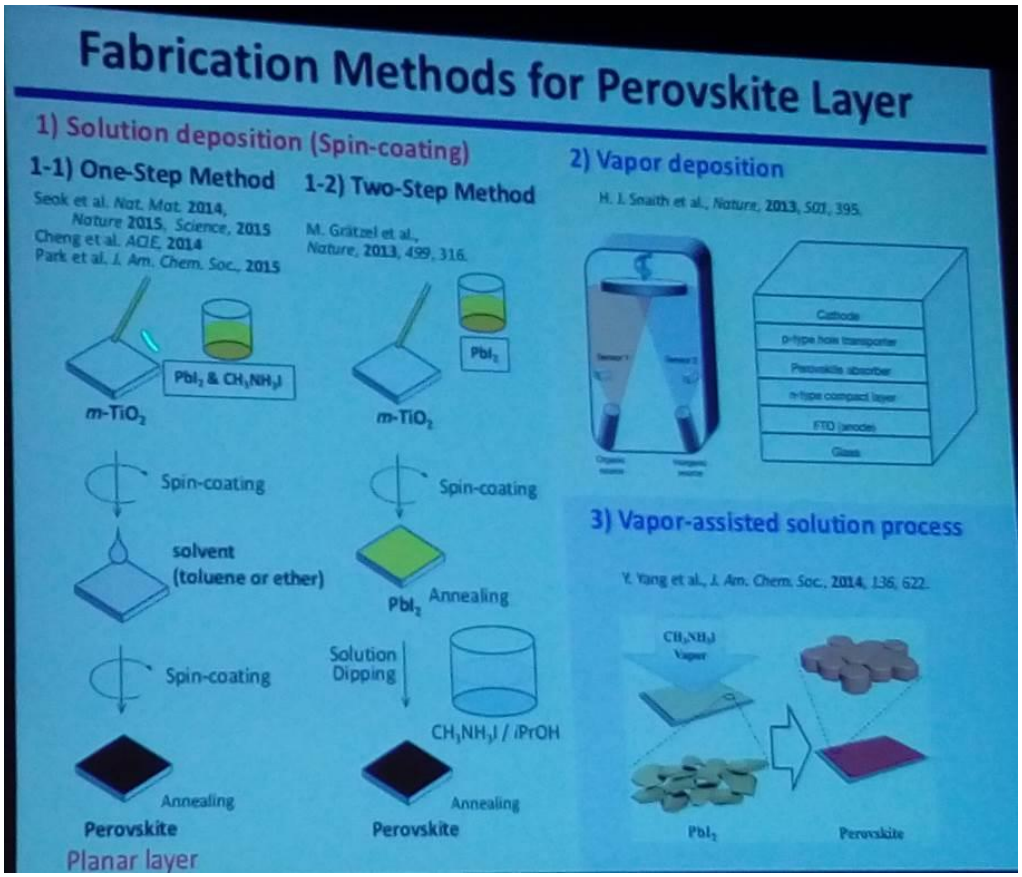


圖十九、鈣鈦礦材料在許多光電材料領域已是熱門的研發主題

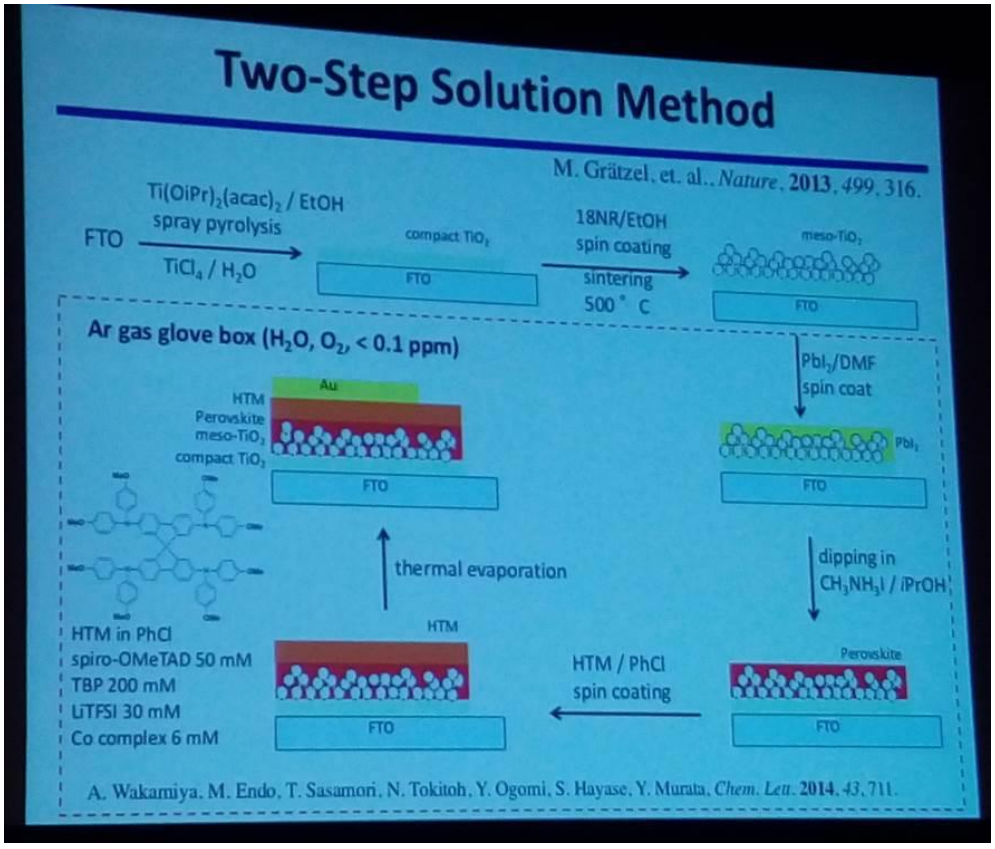


圖二十、鈣鈦礦材料藉由不同元素材料混合組成達成調變半導體材料的能隙

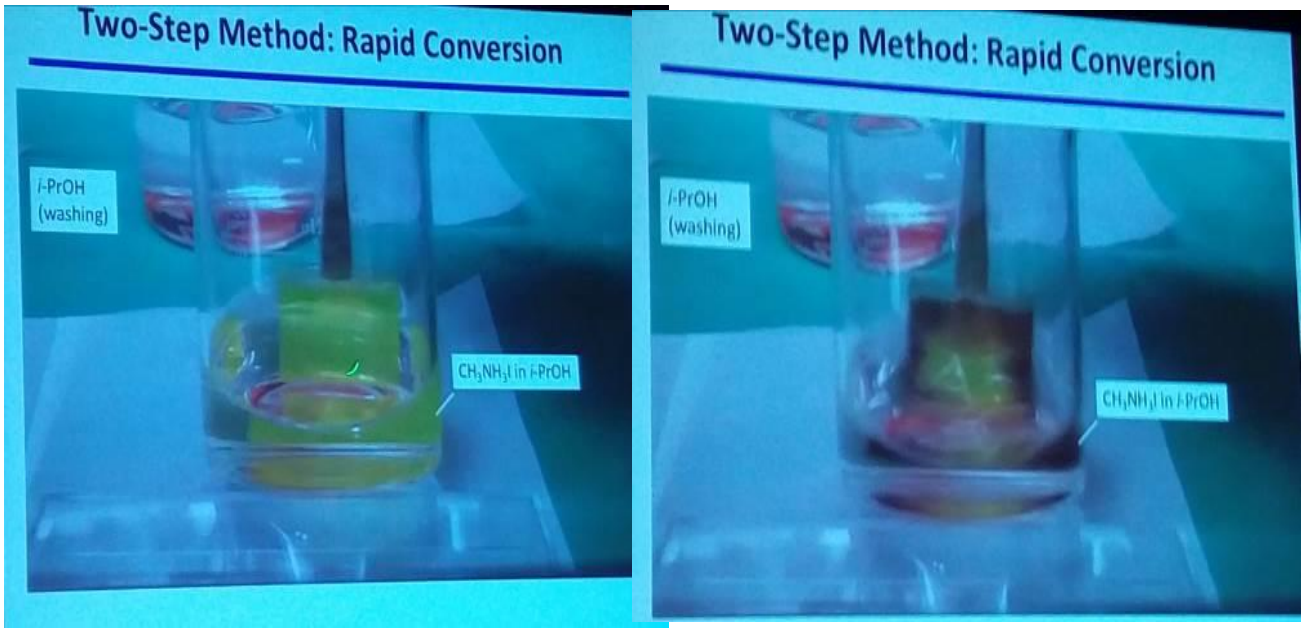
此外，關於鈣鈦礦薄膜太陽能電池的研發，更在開幕當天下午主要演講邀請到京都大學的若宮教授針對其研究團隊的在鈣鈦礦薄膜太陽能電池研究進展發表研發成果。該團隊主要是以化學合成技術針對應用在鈣鈦礦薄膜太陽能電池的關鍵材料進行研發，主要的研發領域為電子型二氧化鈦(TiO_2)半導體薄膜、電洞型鈣鈦礦(Perovskite)半導體薄膜、電洞傳輸膜 Spiro-OMeTAD 等材料。如圖二十一所示，目前製作鈣鈦礦薄膜的技術主要是以蒸鍍、蒸鍍結合溶液以及化學溶液合成三種技術為主，而化學溶液合成技術又區分為一次到位的一階段及分段反應的兩階段合成方式，若宮教授團隊採用的是分段反應的兩階段合成方式。如圖二十二所示，為該團隊針對鈣鈦礦薄膜合成以及太陽能電池元件製作的主要製程步驟。其技術主要是藉由 PbI_2 溶於 DMF 溶液並以旋塗的方式塗佈於 TiO_2 薄膜上成膜，接著將此薄膜浸泡於 CH_3NH_3I/iPrOH 溶液中完成鈣鈦礦半導體薄膜製作。若宮教授在現場播放合成薄膜的相關紀錄影片，根據其影片可發現薄膜參與反應的速度極快，約幾秒內即可完成鈣鈦礦薄膜的合成步驟，如圖二十三所示。而本技術主要的關鍵點在於配製溶液時能否有效降低水的含量，如圖二十四所示，若溶液中含水的成分較高(2000ppm)時，所配製之溶液將呈現較為混濁的狀態，導致所製作出來的薄膜太陽能電池光電轉換效率僅為 5.2%。然而，若能將溶液含水量有效降低，當溶液含水量低於100ppm時，則以此溶液合成的鈣鈦礦薄膜所製作出的薄膜太陽能電池，其光電轉換效率可大幅提升至 13.2%左右，說明溶液中水含量的控制在溶液合成的製程中扮演著關鍵的角色。



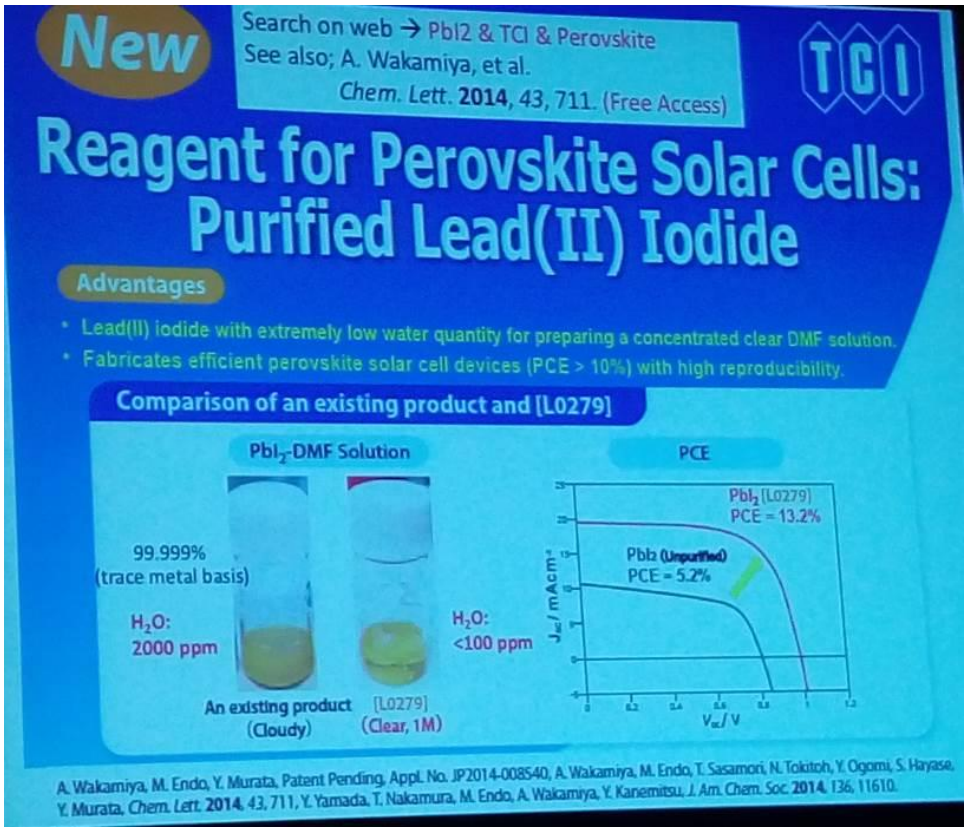
圖二十一、製作鈣鈦礦薄膜的技術分類圖



圖二十二、若宮教授團隊採用兩階段合成方式製作鈣鈦礦薄膜及太陽能電池元件

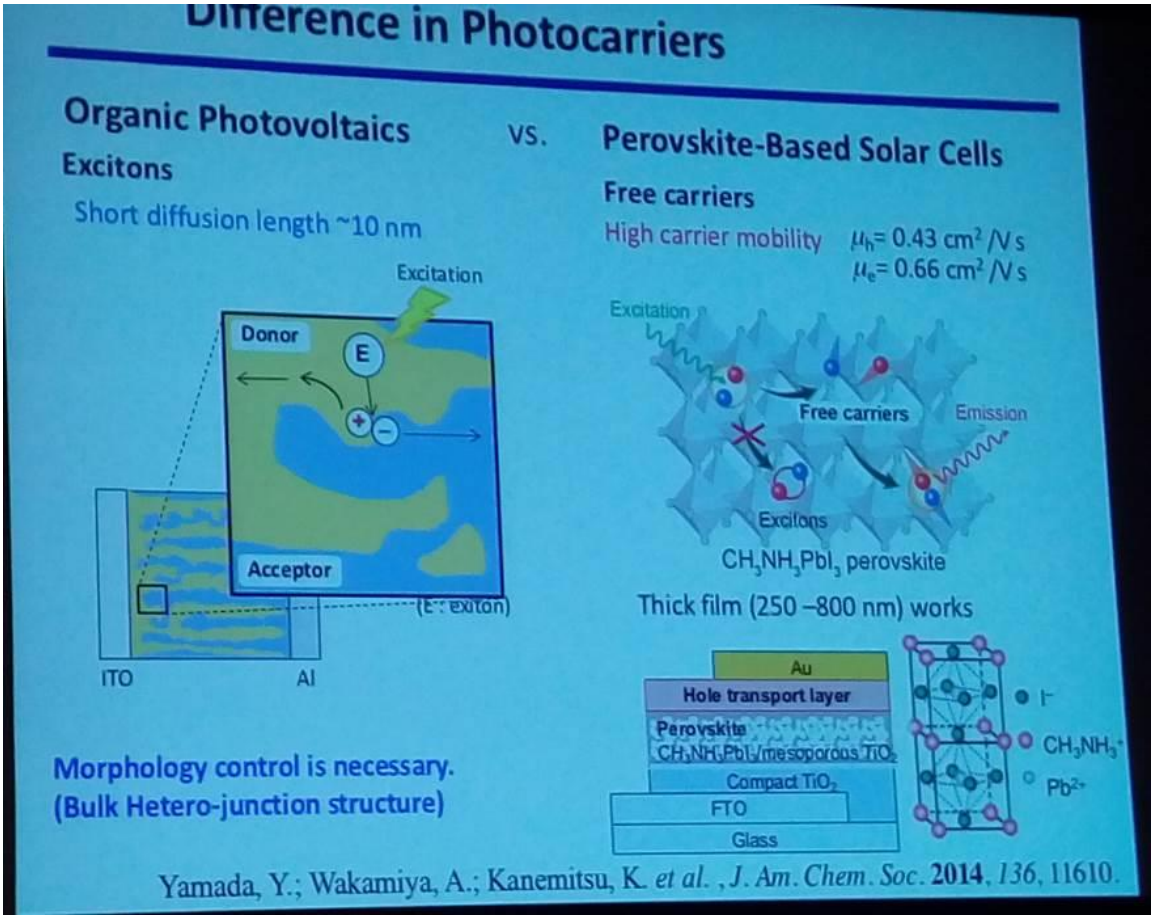


圖二十三、以兩階段成膜的方式完成鈣鈦礦薄膜製作

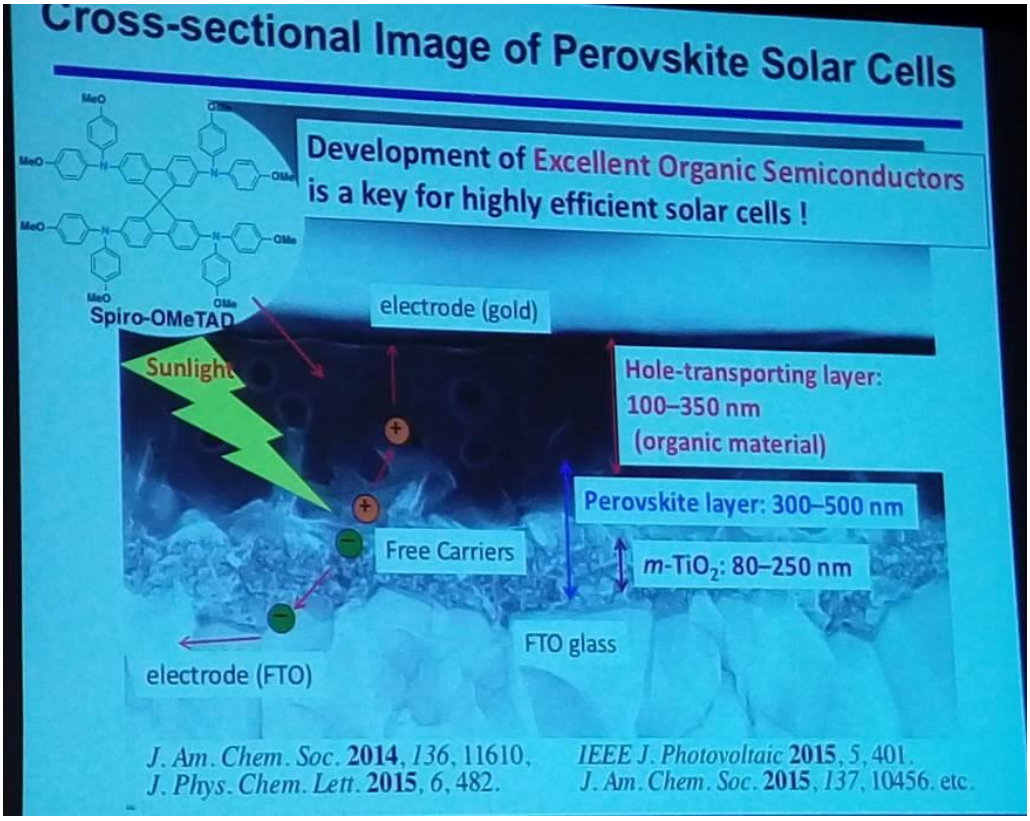


圖二十四、溶液中含水量對於兩階段成膜製作之鈣鈦礦薄膜太陽能電池效率影響

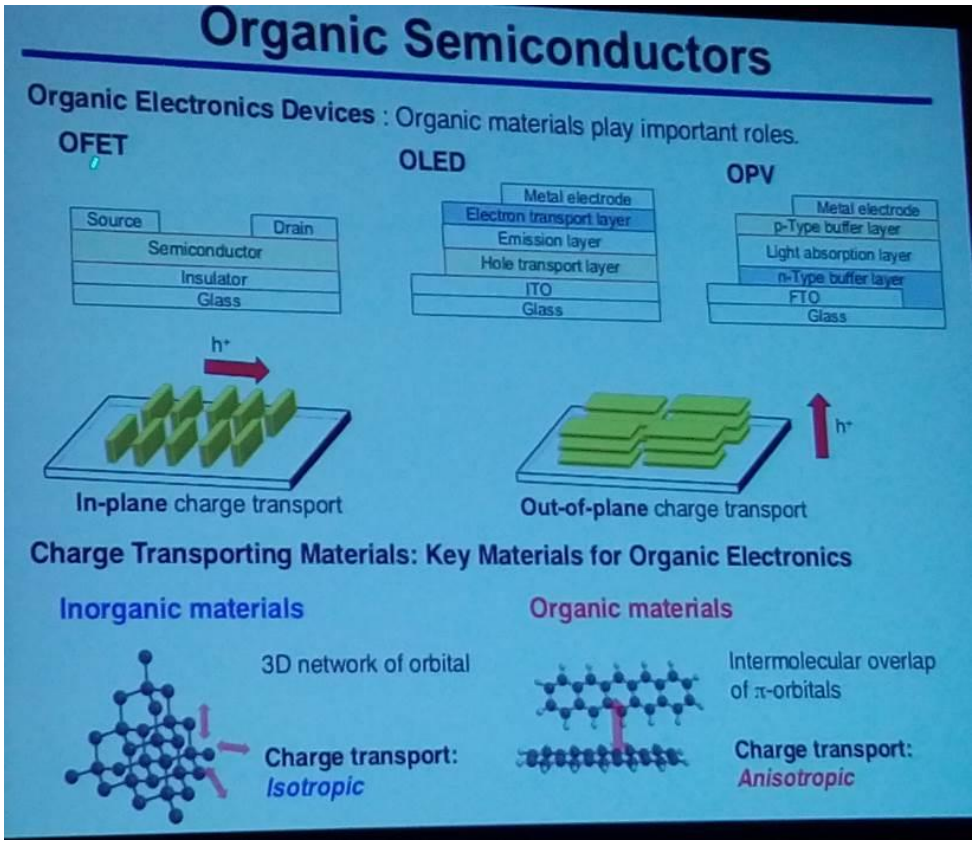
此外，針對鈣鈦礦薄膜太陽能電池的光電傳導機制，亦藉由量測分析技術獲得不同於有機型太陽能電池的結論。如圖二十五所示，鈣鈦礦薄膜太陽能電池的傳導機制主要是以自由載子(Free Carrier)的型式進行傳導，其電洞及電子的移動率分別可達 0.43cm^2/Vs 以及 0.66cm^2/Vs。相對來說，有機型太陽能電池藉由激子(Excition)傳導，其載子的擴散長度僅為 10nm 左右，兩者的傳導型式明顯不同。因此，對於有機型薄膜太陽能電池而言著重於藉由表面形貌提升光電效應。而對於鈣鈦礦薄膜太陽能電池來說，由於載子具有高的移動率，因此鈣鈦礦薄膜有效的薄膜反應厚度介於 250nm 至 800nm 間，因此在結構上必須有另外的考量，如圖二十六所示，根據若宮教授研究團隊的研究指出，提升光電轉換效率的另一個關鍵在於取代電洞傳輸膜材料 Spiro-OMeTAD。如圖二十七所示，此電洞傳輸膜材料因應薄膜太陽能電池的應用，載子傳導方向為垂直於基板方向的傳導，因此必須根據此應用特性設計相關材料取代電洞傳輸膜材料。如圖二十八所示，若宮教授研究團隊也成功藉由材料的合成技術開發相對應的電洞傳輸膜材料，將電洞移動率由原本的 0.5 cm^2/Vs 提升至 1.8 cm^2/Vs，並以此新材料製作出光電轉換效率達 15.7%之鈣鈦礦薄膜太陽能電池，相關元件特性比較如圖二十九所示。此外，採用一階段合成鈣鈦礦薄膜的方式可獲得表面較為平整的鈣鈦礦薄膜，以新電洞傳輸膜材料搭配表面較為平坦之鈣鈦礦薄膜所獲得之鈣鈦礦薄膜太陽能電池光電轉換效率可達 16.5%，相關元件製程步驟及特性如圖三十所示。圖三十一為採用一階段及兩階段合成之鈣鈦礦薄膜以掃描式電子顯微鏡拍攝其橫切面圖，可以發現採用一階段合成之鈣鈦礦薄膜較為平坦且光電轉換效率較高。



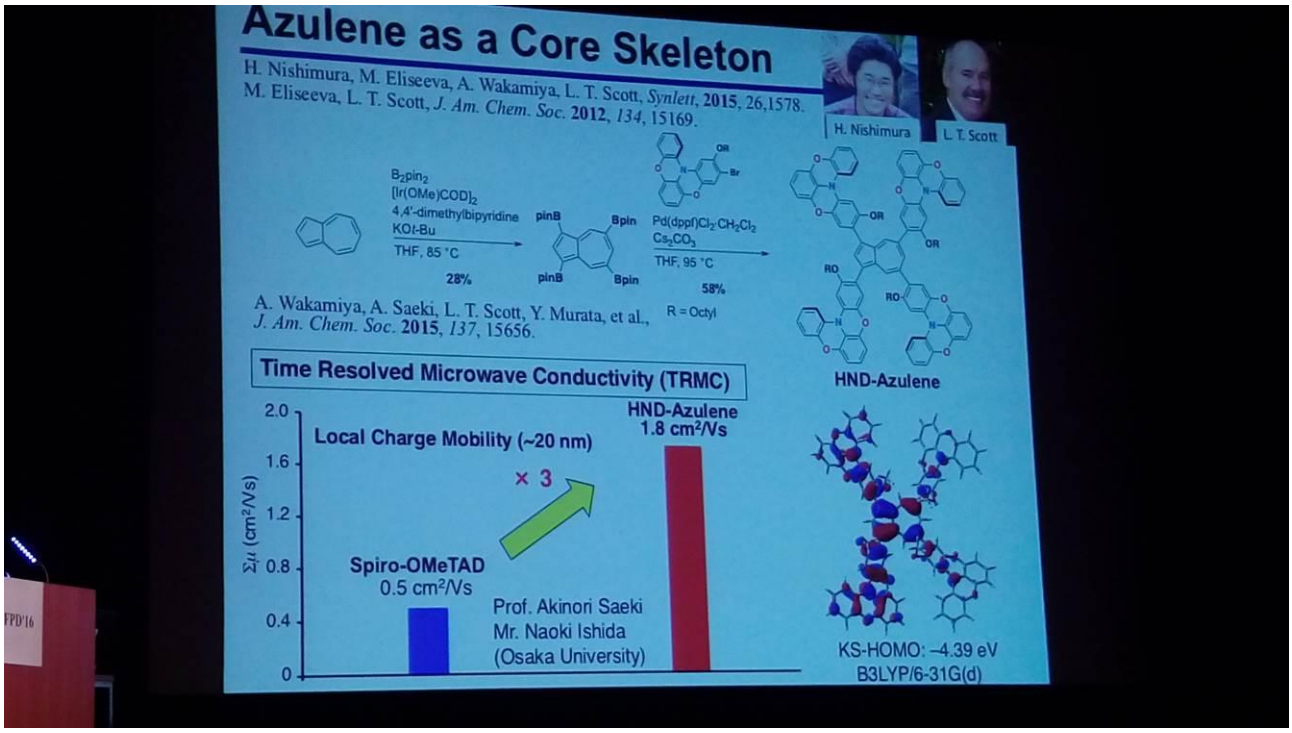
圖二十五、鈣鈦礦薄膜太陽能電池與有機型薄膜太陽能電池載子傳導機制差異比較



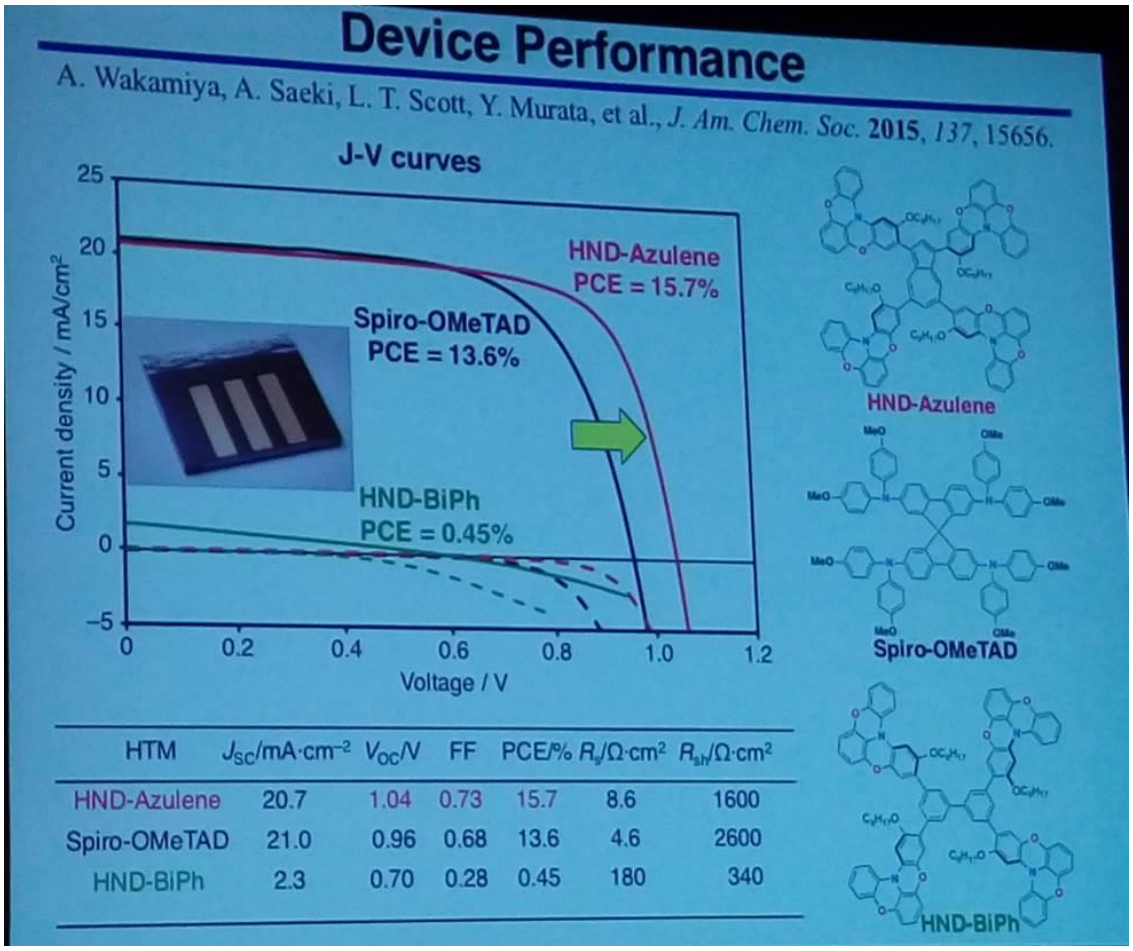
圖二十六、鈣鈦礦薄膜太陽能電池光電轉換效率提升的另一個關鍵為取代電洞傳輸膜材料



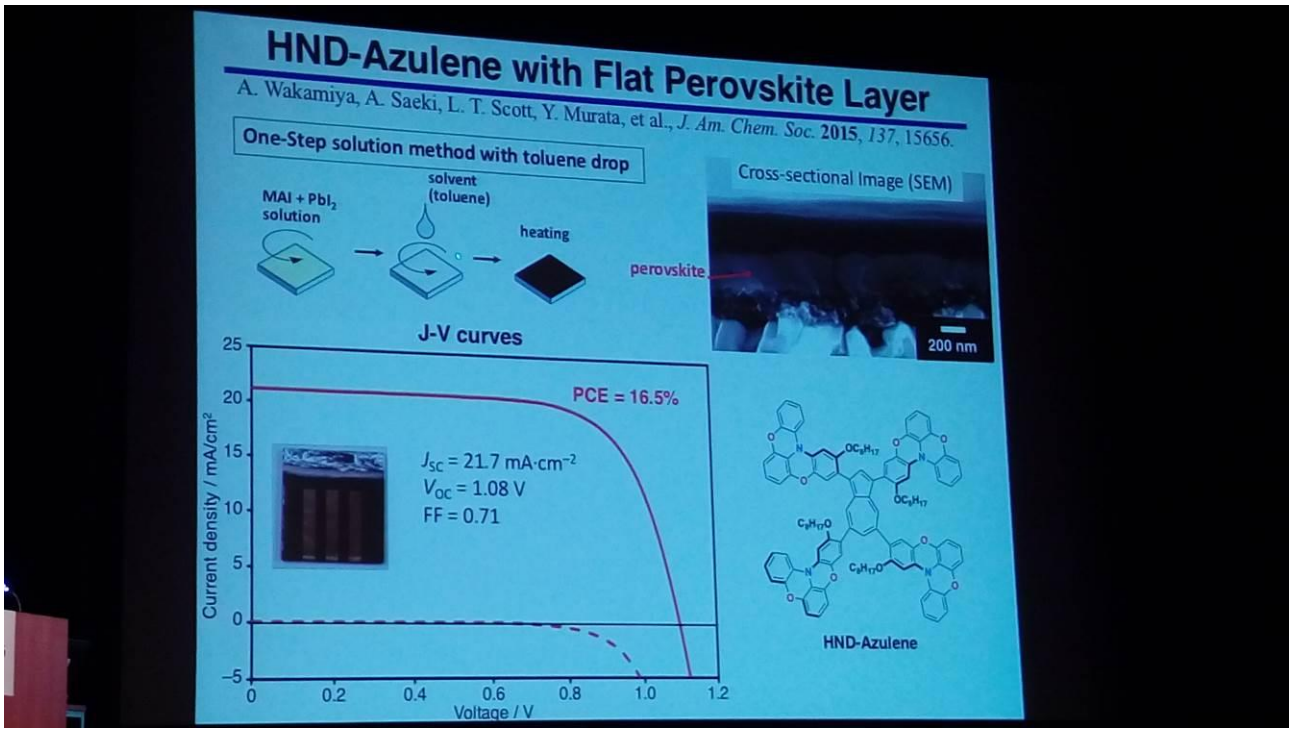
圖二十七、電洞傳輸膜材料因應不同元件應用其載子傳導方向的需求差異



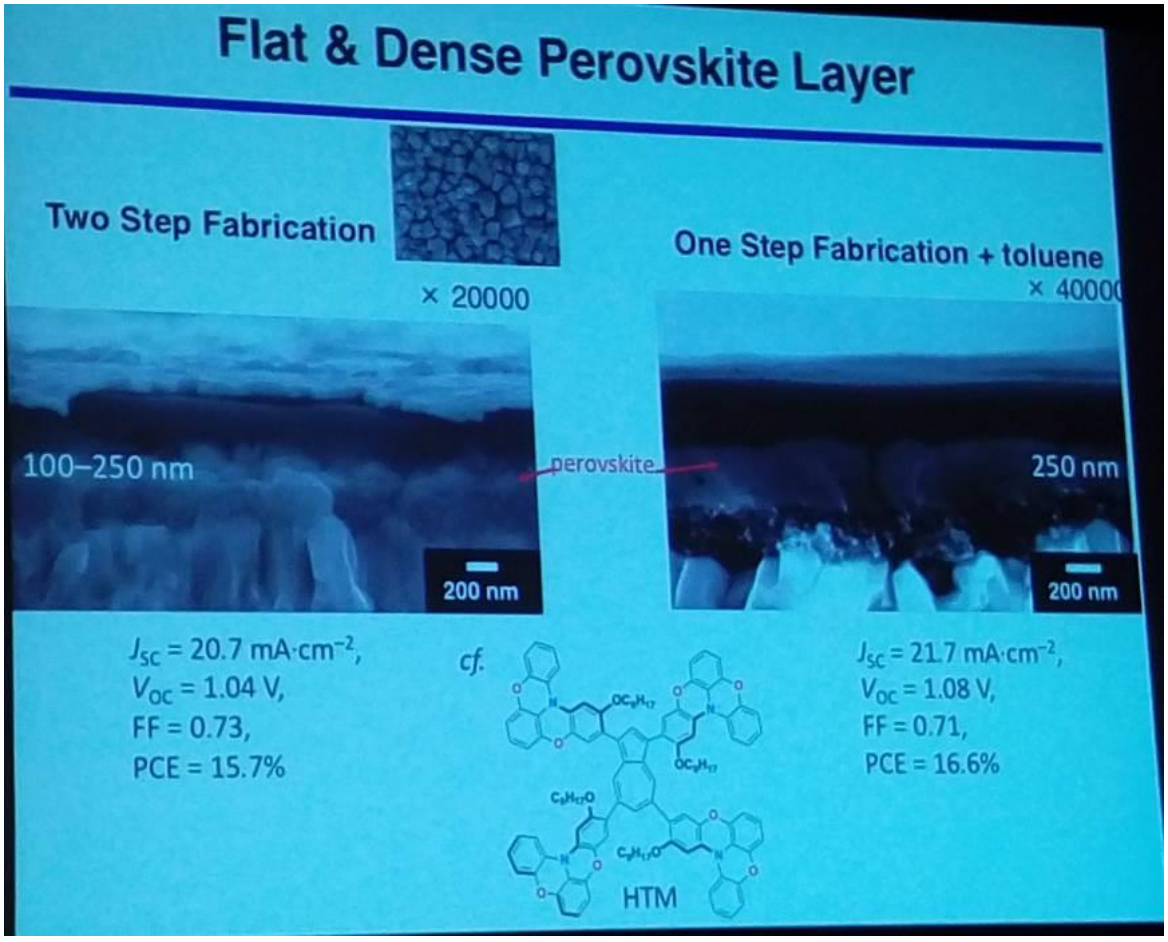
圖二十八、若宮教授研究團隊所開發之材料將電洞移動率由 0.5 cm^2/Vs 提升至 1.8 cm^2/Vs



圖二十九、使用不同電洞傳輸層材料之鈣鈦礦薄膜太陽能電池元件特性比較

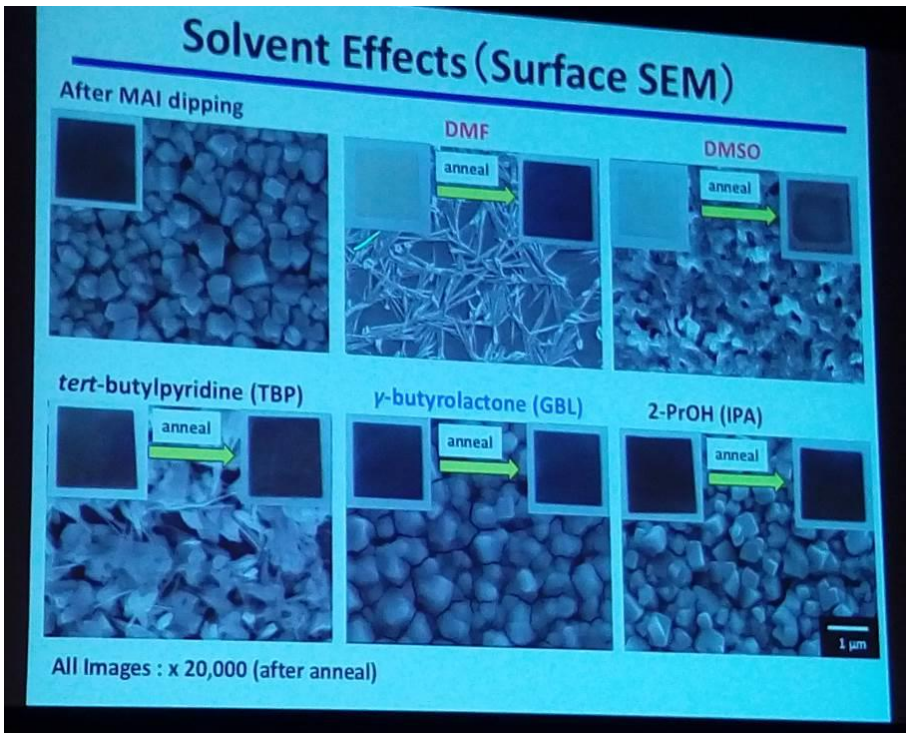


圖三十、新電洞傳輸層材料搭配一階段合成表面平坦之鈣鈦礦薄膜太陽能電池元件特性圖

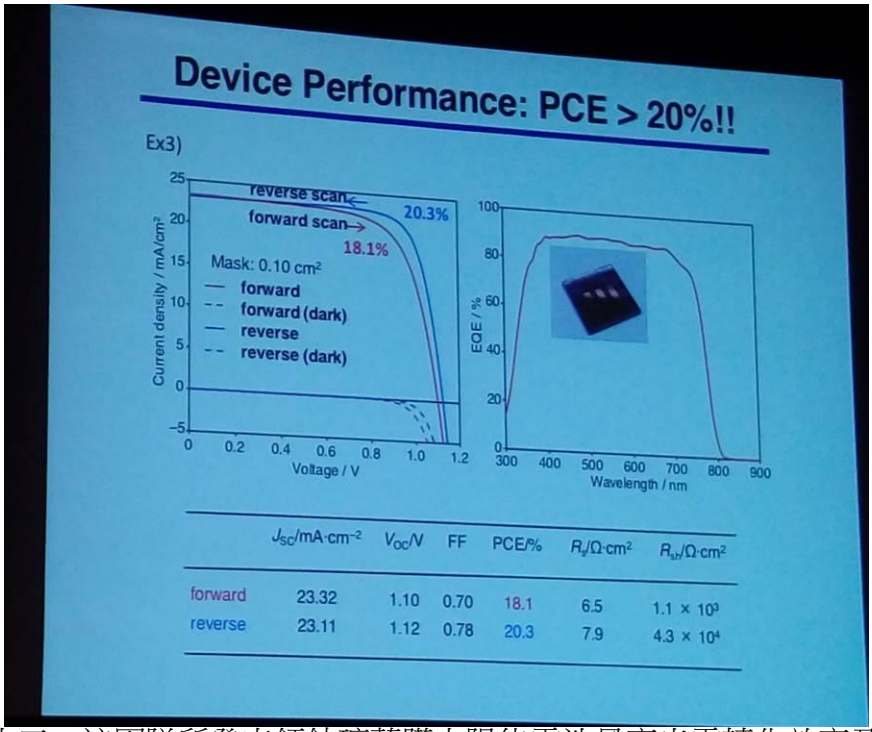


圖三十一、採用一階段及兩階段合成之鈣鈦礦薄膜 SEM 橫切面圖

此外，若採用一階段合成之製程方式，以不同的溶液合成鈣鈦礦薄膜也會有不同的表面形貌，如圖三十二所示。而若宮教授的研究團隊也發現在一階段合成的製程中以 DMF 溶液製作之鈣鈦礦薄膜具有最佳之特性，並以此薄膜搭配自行研發之電洞傳輸層材料，一舉將鈣鈦礦薄膜太陽能電池的光電轉化效率提升至 20.3%，元件特性如圖三十三所示。該團隊在此領域的研發藉由元件的傳導機制搭配相對應的溶液及薄膜材料開發，成功將鈣鈦礦薄膜太陽能電池的光電轉化效率提升，值得國內外相關研究單位借鏡與學習。



圖三十二、以不同溶液進行一階段合成鈣鈦礦薄膜之表面形貌差異性



圖三十三、該團隊所發表鈣鈦礦薄膜太陽能電池最高光電轉化效率及特性圖

四、建　議　事　項

(一) 電漿製程技術仍為光電元件鍍膜發展主流，利用電漿沉積薄膜技術仍是會議論文發表重點項目，此研發方向與本組目前電漿領域發展方向一致，值得繼續投入研究。

(二) 透明半導體元件已走向實際應用及導入現有光電廠產製的階段，其主流製程技術仍為濺鍍技術，與本組現有的電漿開發經驗相符，可針對此材料於其它領域之應用進行先期開發研究。

(三) 鈣鈦礦型太陽能電池材料開發為太陽能電池研發重點項目，研發方向為藉由低成本、對環境無害材料及製程取代現有薄膜材料合成技術，但藉由電漿及蒸鍍成膜的技術仍佔有一席之地，可針對其應用進行重點研發。

(四) 針對鈣鈦礦型太陽能電池薄膜材料合成技術方面，日本已有不錯的突破，建議可藉由國際合作方式加速本所在此領域的研發速度。

五、附　錄

2016 年主動式矩陣顯示元件國際研討會(AM-FPD”16)相關資料

PROGRAM

AM-FPD 16

THE TWENTY-THIRD INTERNATIONAL WORKSHOP ON

ACTIVE-MATRIX FLATPANEL DISPLAYS AND DEVICES

-TFT TECHNOLOGIES AND FPD MATERIALS-

JULY 6-8, 2016
Ryukoku University Avanti Kyoto Hall
Kyoto, Japan

Sponsorship:
International Society of Functional Thin Film Materials & Devices

Co-Sponsorship:
The Japan Society of Applied Physics

Technical Sponsorship:
The Electrochemical Society - Electronics and Photonics Division -
The Electrochemical Society - Japan Section -
IEEE Electron Devices Society

In cooperation with:
The Institute of Electronics, Information and Communication Engineers
The Institute of Image Information and Television Engineers
The Institute of Electrical Engineers of Japan
The Chemical Society of Japan
Japanese Liquid Crystal Society
Thin Film Materials & Devices Meeting

GENERAL INFORMATION

The 23rd International Workshop on Active-Matrix Flatpanel Displays and Devices (AM-FPD '16) will be held at Ryukoku University Avanti Kyoto Hall, Kyoto, Japan from July 6 (Wednesday) to 8 (Friday), 2016. This international workshop was established in 1994 to present the latest research and development in Active Matrix Liquid Crystal Display technologies and their applications. In addition to AMLCDs and AMOLEDs, the scope has been widened to novel flat panel displays, materials for displays, flexible technologies, related physical phenomena and novel thin-film devices such as thin-film transistors(TFT), photovoltaics (PV) technologies, and other thin-film materials and devices (TFMD).

We hope that you will attend and enjoy our workshop.

SITE

Ryukoku University Avanti Kyoto Hall (Avanti 9th Floor)
31 Higashikujyo-nishisannoucho, Minami-ku, Kyoto 601-8003, Japan (see the map on page 26, 27)

AM-FPD '16 Secretariat Tel: +81-475-23-1150

WORKSHOP THEME

AM-FPD '16 will prepare an attractive program focusing on "What's Going on and What's the Next ? ".

SYMPOSIUM

In addition to the regular sessions, symposia, "*Development and Future Innovation of TFT Technology*", "*Next-Generation Thin-Film Solar Cells*" and "*Thin-Film Materials for Sensing Devices*" are scheduled. Invited speakers will talk about the latest topics from the viewpoints of functional materials, device structures, fabrication processes, driving scheme, circuit technologies, etc.

PRESENTATION TIMES FOR SPEAKERS

	Total	Presentation	Discussion
Keynote	30 min.	25 min.	5 min.
Invited	25 min.	20 min.	5 min.
Symposium	30 min.	25 min.	5 min.
Oral	20 min.	15 min.	5 min.
Poster	15:35-18:00, July 7		
Late News	15 min.	12 min.	3 min.

THE PROCEEDINGS OF AM-FPD '16

The Proceedings of AM-FPD '16 will be distributed from July 6 at the Registration Desk.

LANGUAGE

The official language of the workshop is English.

REGISTRATION

The Registration Desk will be open in front of Ryukoku University Avanti Kyoto Hall from Wednesday to Friday.
The registration hours are as follows:

Wednesday, July 6	9:30-17:00
Thursday, July 7	9:15-17:00
Friday, July 8	9:15-14:00

For Advance Registration, access our online registration page (http://www.amfpd.jp) and enroll your information and complete payment by June 8(JST). Registration and other fees should be paid in Japanese yen via bank transfer*[1] or credit cards. VISA, Master, DC, AMEX, Diners, Nicos and JCB are acceptable. No personal checks are acceptable. After your payment has been confirmed, confirmation can be downloaded from our online registration page.

*[1] Bank transfer for AM-FPD
A/C No.: 3106887 Mizuho Bank, Ltd. Jugogou Branch
A/C Name: Nippon Travel Agency Co., Ltd.
Registrants living in Japan can make payment via bank transfer or credit cards. Registrants living overseas can make payment by credit cards only.

Category	Advance Registration By June 8, 2016(JST)	On-Site Registration
WORKSHOP*[2]		
Member*[3]	¥50,000	¥55,000
Non-Member	¥52,000	¥57,000
Student*[4]	¥15,000	¥17,000
TUTORIAL		
Regular	¥5,000	¥5,000
Conference attendee & Student	¥3,000	¥3,000

*[2]The registration fee of the workshop includes the admission to all sessions and USB memory of the proceedings. The banquet of AM-FPD '16 will be served without additional charge.

*[3]The member of the societies which sponsor and support AM-FPD '16. (see the front cover)

*[4]Students are required to show their ID card.

BANQUET

The banquet will be held on July 6, from 18:00 to 20:00 at Mariage Grande “Glove” on the 8th floor of Avanti.

VISAS

Every foreign visitor entering Japan must have a valid passport. Visitors from countries whose citizens must have visas should apply to a Japanese consular office or diplomatic mission in their own country.

CANCELLATION POLICY

In case of cancellation, a written notification should be sent to NTA by e-mail (am_fpd16@nta.co.jp) or by FAX (+81-43-225-2241) to avoid any trouble.

Cancel Charge

From June 9 to 27---------JPY 3,000

After June 28---100% of the registration fee / NO REFUND

The Proceedings of the AM-FPD '16(USB memory) will be sent to the attendees who have paid in 100% cancellation charge after the workshop.

Official Travel Agent

Nippon Travel Agency Co., Ltd. (NTA) has been appointed as the official travel agent for the workshop and will handle all related travel arrangements, including hotel accommodations. Inquiries and applications concerning arrangements should be addressed to:

Nippon Travel Agency Co., Ltd.(NTA)
Chiba Branch
Chiba Center Square Bldg. 4F, 2-3-16, Chuo, Chuo-ku, Chiba 260-0013, Japan
Fax: +81-43-225-2241 Tel: +81-43-227-2307
E-mail: am_fpd16@nta.co.jp

JAPANESE JOURNAL OF APPLIED PHYSICS SPECIAL ISSUE

The authors of the superior papers are recommended by the committee to submit their papers for publication in the JJAP (Japanese Journal of Applied Physics) special issue of "Active-Matrix Flatpanel Displays and Devices -TFT Technologies and FPD Materials-" (Vol. 56, No. 3, 2017). The manuscript should contain some novel, original and significant parts in addition to your presentation in AM-FPD '16.

Any papers submitted to a special issue should not have text identical to a paper distributed in the associated conference (meeting etc.). The content of the paper must be original with well-developed discussions on the obtained results. The submission must be made through the below online submission no later than July 25, 2016.

Submission & Information:
https://journals.jsap.jp/jjap/special-issues/online-submission-to-jjap-special-issues /

The review schedule is as follows:
- July 25, 2016: Submission
- Mid-December, 2016: Final decision
- March, 2017: Publication

BENEFIT

1. The publication charge is a lower price of 20000JPY/article.
2. An accepted article is published online on IOP science as early as about 6 months after submission.
3. Open access or free access is available for any accepted article for one year after the publication.
4. One excellent original paper is honored as Best Paper Award in AM-FPD'16 from the accepted ones.

IEEE XPLORE DIGITAL LIBRARY

The Proceedings of AM-FPD '16 will be published in the IEEE Xplore digital library in around 2 months after the workshop.

TUTORIAL IN JAPANESE

These classes are widely aimed at many people from beginners to researchers who hope to review their knowledge. Presentations and documents will be in Japanese. Documents will be distributed to the attendees who have registered in advance. The attendees who make an entry on-site will be admitted into these classes, but no documents might be handed. These classes are available for an additional fee (see page 2.)

Wednesday, July 6 (10 : 00 ～ 12 : 00)
Chairperson : H. Okada, *Univ. of Toyama, Japan*

10:00 (T-1)	Advances in Oxide Semiconductors and Their Devices Hideya Kumomi, *Tokyo Inst. of Technol., Japan*
11:00 (T-2)	Metal Halide Perovskite Semiconductors for Solar Cells Takashi Kondo, *The Univ. of Tokyo, Japan*

AWARD

Papers presented at this workshop will be considered for “AM-FPD Paper Awards”, “AMFPD-ECS Japan Section Young Researcher Award” and “JJAP Best Paper Award”. These winners will be presented at the award ceremony in AM-FPD '16 workshop.

AM-FPD Paper Awards

“Best Paper Award”, “Poster Award” and “Student Paper Award” will be presented. The winners of them are selected by AMFPD '15 award committee chaired by Professor Yukiharu Uraoka (*NAIST*).

AMFPD-ECS Japan Section Young Researcher Award

ECS Japan Section and AM-FPD Organizing Committee have jointly established “AMFPD-ECS Japan Section Young Researcher Award”. This award will be given to the author under the age of 35 that belongs to the university or the research institute in Japan.

JJAP Best Paper Award

JJAP Best Paper Award will be given to an excellent original paper in the papers which will be submitted to JJAP special issue of "Active-Matrix Flatpanel Displays and Devices -TFT Technologies and FPD Materials-".

AM-FPD '15 PAPER AWARD

Best Paper Award

(2-3) Nonvolatile Memory Performances of Transparent and/or Flexible Memory Thin-Film Transistors Using IGZO Channel and ZnO Charge-Trap Layers

So-Jung Kim, Won-Ho Lee, Sung-Min Yoon, *Kyung Hee Univ., Korea*

Poster Award

(P-11) Bending Performance and Bias-Stress Stability of the In-Ga-Zn-O TFTs Prepared on Flexible PEN Substrates with Optimum Barrier Structures

Min-Ji Park[1], Da-Jung Yun[1], Min-Ki Ryu[2], Jong-Heon Yang[2], Jae-Eun Pi[2], Gi-Hyun Kim[2], Chi-Sun Hwang[2], Sung-Min Yoon[1], *[1]Kyung Hee Univ., Korea, [2]Electronics & Telecommunication Res. Inst., Korea*

(P-18) Molecular Alignment Control of Pentacene Molecules Deposited on a Photocrosslinkable Liquid-Crystalline Polymer Film with Various Thicknesses

Mizuho Kondo, Takao Nakanishi, Akira Heya, Naoto Matsuo, Nobuhiro Kawatsuki, *Univ. of Hyogo, Japan*

Student Paper Award

Kahori Kise, *Nara Inst. of Sci. and Technol., Japan*

(7-3) Analysis of Self-Heating Phenomenon in Oxide Thin-Film Transistors under Pulsed Bias Voltage

AMFPD-ECS Japan Section Young Researcher Award

Masahiro Horita, *Nara Inst. of Sci. and Technol., Japan*

(6-3) Unseeded Growth of Poly-Crystalline Ge with (111) Surface Orientation on Insulator by Pulsed Green Laser Annealing

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Akira Okada (*GOIC*)
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Advisor : Makoto Ohkura

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Yung-Hui Yeh (*ITRI*)
Wen-Chang Yeh (*Shimane Univ.*)

PROGRAM

Wednesday, July 6

Opening Session (13 : 00 ～ 13 : 15)
Chairperson : H. Tanabe, *NLT Technologies, Japan*

Welcome Address
H. Hamada, *Kinki Univ., Japan*
Award Presentation

Session 1 : Keynote Address (13 : 15 ～ 14 : 15)
Chairpersons : H. Okada, *Univ. of Toyama, Japan*
H. Tanabe, *NLT Technologies, Japan*

13 : 15 (1-1) AM-FPDs will Make Further Progress with 8K System and Olympic Games (Invited)
T. Kurita, *NHK Media Technol., Japan*

13 : 45 (1-2) Recent Progress on Perovskite Solar Cells and Our Materials Science (Invited)
A. Wakamiya, *Kyoto Univ., Japan*

Session 2 : Novel Application of TFTs
(14 : 15 ～ 15 : 20)
Chairpersons : S. -H. Jin, *Incheon Nat'l Univ., Korea*
A. Heya, *Univ. of Hyogo, Japan*

14 : 15 (2-1) Nanomaterial-Based Flexible and Wearable Sensor Sheets (Invited)
K. Takei, *Osaka Prefecture Univ., Japan*

14 : 40 (2-2) Evaluation of pH Sensors Using Self-Aligned Four-Terminal Planar Embedded Metal Double-Gate Low-Temperature Polycrystalline-Silicon Thin-Film Transistors on Glass Substrate
H. Ohsawa, H. Suzuki, S. Kuwano, A. Hara, *Tohoku Gakuin Univ., Japan*

15 : 00 (2-3) Brain-Like Synaptic Operations of Thin-Film Transistors Using In-Ga-Zn-O Active Channel and PVP-SBA Electrolytic Gate Insulator
Y. -M. Kim[1], E. -J. Kim[1], W. -H. Lee[1], J. -Y. Oh[2], S. -M. Yoon[1], [1]*Kyung Hee Univ., Korea,* [2]*Electronics & Telecommunication Res. Inst., Korea*

― *Coffee Break* ―

Session 3 : Novel Application on Photovoltaics
(15 : 35 ～ 16 : 45)

Chairpersons : A. Masuda, *AIST, Japan*
T. Itoh, *Gifu Univ., Japan*

15 : 35 (3-1) Solar Radiation Forecast with Machine Learning (Invited)
X. Shao, S. Lu, H. F. Hamann, *IBM, USA*

16 : 00 (3-2) Local Photovoltaic Characterization of Si Thin Film Solar Cells (Invited)
T. Itoh, *Gifu Univ., Japan*

16 : 25 (3-3) Lateral Thin-Film Poly-Si Solar Cell Prepared By Low Temperature Ni Silicide-Induced Crystallization
Z. Kiaee, S. K. Joo, *Seoul Nat'l Univ., Korea*

Late News (16:45 ～ 17:15)

16 : 45 (L-1) Charge Effects of Ultrafine FET with Nanodot Type Floating Gate
T. Ban[1], S. Migita[2], Y. Uraoka[3], S. Yamamoto[1], *[1]Ryukoku Univ., Japan, [2]Nat'l Inst. of Advanced Industrial Sci. and Technol., Japan, [3]Nara Inst. of Sci. and Technol., Japan*

17 : 00 (L-2) Novel Bi-Direction Gate Driver Circuit for Active-Matrix LCDs with In-Cell Touch Structures
P. -S. Chen, Y. -T. Liu, C. -L. Lin, *Nat'l Cheng Kung Univ., Taiwan*

Author Interviews (17 : 15 ～ 17 : 45)

Banquet (18 : 00 ～ 20 : 00)

Symposium 1 : Development and Future Innovation of TFT Technology (9 : 15 ～ 10 : 45)

Chairpersons : S. -M. Yoon, *Kyung Hee Univ., Korea*
M. Furuta, *Kochi Univ. of Technol., Japan*

9 : 15 (S1-1) Development of Organic Semiconducting Technology to Realize Low Driving Voltages (Invited)
M. He[2], C. Wang[1], W. -Y. Lee[1], D. Kong[1], R. Pfattner[1], W. Niu[2], J. R Matthews[2], A. Wallace[2], Z. Bao[1], *[1]Stanford Univ., USA [2]Corning Incorporated, USA*

9 : 45 (S1-2) Large-Area Solution-Printed Metal Oxide Electronics (Invited)
W. -J. Lee, S. Park, M. -H. Yoon, *Gwangju Inst. of Sci. and Technol., Korea*

10 : 15 (S1-3) Single-Walled Carbon Nanotubes (SWNTs); History and Future Prospects for Electronic Applications (Invited)
S. H. Jin, *Incheon Nat'l Univ., Korea*

― *Coffee Break* ―

Symposium 2 : Thin-Film Materials for Sensing Devices (11 : 00 ～ 12 : 20)

Chairpersons : H. Naito, *Osaka Prefecture Univ., Japan*
H. Kajii, *Osaka Univ., Japan*

11 : 00 (S2-1) A Tube-in-a-Tube Semiconductor (Invited)
A. L. Ng, Y. Wang, *Univ. of Maryland, USA*

11 : 30 (S2-2) Graphene Field-Effect Transistor for Biosensor (Invited)
K. Matsumoto, R. Hayashi, Y. Kanai, K. Inoue, T. Ono, *Osaka Univ., Japan*

12 : 00 (S2-3) Reduction of Graphene Oxide by Atomic Hydrogen Annealing
A. Heya, N. Matsuo, *Univ. of Hyogo, Japan*

― *Lunch* ―

Symposium 3 : Next-Generation Thin-Film Solar Cells
(13 : 35 ～ 15 : 05)

Chairpersons : K. Ohdaira, *JAIST, Japan*
T. Suemasu, *Univ. of Tsukuba, Japan*

13 : 35 (S3-1) Optoelectronic Properties and Photo-Physics of Large Grain Hybrid Perovskites (Invited)
A. D. Mohite, W. Nie, J. C. Blancon, H. Tsai, G. Gupta, *Los Alamos Nat'l Lab., USA*

14 : 05 (S3-2) Recent Progress in $BaSi_2$ Solar Cells (Invited)
T. Suemasu, *Univ. of Tsukuba, Japan*

14 : 35 (S3-3) Fabrication of Earth-Abundant CZTS Thin Film Solar Cells (Invited)
H. Katagiri, K. Jimbo, *Nat'l Inst. of Technol., Nagaoka College, Japan*

Author Interviews (15 : 05 ～ 15 : 35)

Poster Session (15 : 35 ～ 18 : 00)

Chairpersons : H. Okada, *Univ. of Toyama, Japan*
R. Hattori, *Kyushu Univ., Japan*
S. Horita, *JAIST, Japan*
H. Naito, *Osaka Prefecture Univ., Japan*
K. Ohdaira, *JAIST, Japan*

FPDp

(P-1) Highly Efficient and Inverted Tandem Organic Light-Emitting Devices Using a MoO_3/Al/MoO_3 Charge Generation Layer
T. -H. Yeh[1], P. -C. Chang[1], Y. -Z. Li[2], S. -W. Liu[1], S. -B. Chen[2], C. -C. Lee[2], *[1]Ming Chi Univ. of Technol., Taiwan, [2]Nat'l Taiwan Univ. of Sci. and Technol., Taiwan*

(P-2) Optimal Parameters for Parallax Multi-Viewer Curved Autostereoscopic Display
Y. -J. Yang[1], W. -C. Lin[1], Y. -J. Chen[1], K. -C. Huang[2], H. Y. Lin[1], *[1]Nat'l Taiwan Univ., Taiwan, [2]Industrial Technol. Res. Inst., Taiwan*

(P-3) Block-Based Content Adaptive Backlight Controller VLSI Design for Local Dimming LCDs
S. -L. Chen[1], H. -J. Tsai[1], T. -L. Lin[1], H. -Y. Lee[2], *[1]Chung Yuan Christian Univ., Taiwan, [2]Abbeydorney HK Limited., Hong Kong*

(P-4) Factorial Designs of Multi-Coatings for Induced Stresses of Advanced Flexible Displays
C. -C. Lee, *Chung Yuan Christian Univ., Taiwan*

(P-5) Novel a-IGZO Pixel Circuit Adopting External Circuit for Use in 3-D AMOLED Displays
M. -X. Wang, P. -S. Chen, C. -L. Lin, *Nat'l Cheng Kung Univ., Taiwan*

(P-6) Mesh-Based Hologram Synthesis for Holographic Wavefront Printer
J. Hong, Y. Kim, S. Hong, C. Shin, H. Kang, *Korea Electronics Technol. Inst., Korea*

(P-7) Novel Pixel Circuit to Enlarge Operation Voltage for Blue-Phase Liquid Crystal Displays
C. -H. Chang, C. -L. Lin, P. -S. Chen, *Nat'l Univ. of Cheng Kung, Taiwan*

(P-8) Extraction Efficiency of Organic Light Emitting Diodes with Two-Dimensional Photonic Quasi-Crystal Structure
M. -Y. Chang, C. -C. Lin, M. -Y. Huang, *Nat'l Sun Yat-Sen Univ., Taiwan*

(P-9) Overview of Design Considerations for Electrophoretic E-Paper and Strategies for Achieving Full-Color
B. -R. Yang, *Sun Yat-Sen Univ., China*

(P-10) A New AC Biased Pixel Circuit for Active Matrix Organic Light-Emitting Diode Displays
C. Wang, X. Meng, H. -M. Lam, H. Lu, S. Zhang, *Peking Univ., China*

(P-11) High Performance Green Exciplex OLED
W. -Y. Hung, P. -Y. Chiang, *Nat'l Taiwan Ocean Univ., Taiwan*

(P-12) New PCT Host to Achieve High Efficiency Blue Phosphorescent Organic Light Emitting Diode
H. -J. Gao[1], Y. -H. Hung[1], T. -L. Chiu[1], Y. -C. Li[2], J. -J. Huang[2], H. -C. Ho[3], C. -F. Lin[4], J. H. Lee[2], M. -K. Leung[2], *[1]Yuan Ze Univ., Taiwan, [2]Nat'l Taiwan Univ., Taiwan, [3]Industrial Technol. Res. Inst., Taiwan, [4]Nat'l United Univ., Taiwan*

(P-13) Novel Benzimidazole/Carbazole Hybrid Ambipolar Molecules and Application in PhOLEDs
J. -J. Huang[1], Y. -H. Hung[2], L. -K. Yun[1], M. -K. Leung[1], T. -L. Chiu[2], J. H. Lee[1], *[1]Nat'l Taiwan Univ., Taiwan, [2]Yuan Ze Univ., Taiwan*

(P-14) Blue Phosphorescent Organic Light-Emitting Diode with Triazole Host Achieving High Current Efficiency
Y. -H. Lan[1], Y. -C. Bai[2], N. -J. Chen[1], J. -J. Huang[1], B. -Y. Lin[1], C. -H. Hsiao[1], M. -K. Leung[1], M. -K. Wei[2], C. -F. Lin[3], T. -L. Chiu[4], J. -H. Lee[1], *[1]Nat'l Taiwan Univ., Taiwan, [2]Nati'l Dong Hwa Univ., Taiwan, [3]Nat'l United Univ., Taiwan, [4]Yuan Ze Univ., Taiwan*

(P-15) Flexible Green Phosphorescent Organic Light-Emitting Devices on Copy Paper Substrates
M. -Y. Ha, D. -Y. Yoon, D. -Y. Park, S. -J. Choi, D. -G. Moon, *Soonchunhyang Univ., Korea*

(P-16) Device Performances of Exciplex Organic Light-Emitting Diodes with Different Emitting Layer Thickness
B. -Y. Lin[1], Y. Hsiao[1], M. -Z. Lee[1], P. -C. Tseng[1], T. -L. Chiu[2], C. -F. Lin[3], J. -H. Lee[1], *[1]Nat'l Taiwan Univ., Taiwan, [2]Yuan Ze Univ., Taiwan, [3]Nat'l United Univ., Taiwan*

(P-60) Efficient Red Phosphorescent OLEDs Employing 2-Phenylcarbazoles-Based Hole Transport Materials
C. -H. Chang[1], G. Krucaite[2], D. Lo[1], Y. -L. Chen[1], C. -C. Su[1], T. -C. Lin[1], J. V. Grazulevicius[2], L. Peciulyte[2], S. Grigalevicius[2], *[1]Yuan Ze Univ., Taiwan, [2]Kaunas Univ. of Technol., Lithuania*

(P-L1) Reducing Roll-Off Effect of Efficient Green Quantum-Dot Light-Emitting Diodes via Composition-Gradient Thick-Shell Quantum Dots
H. -T. Vu[1], Y. -K. Su[1], C. -Y. Huang[2], H. -C. Yu[1], R. -K. Chiang[3], C. -J. Chen[3], *[1]Nat'l Cheng Kung Univ., Taiwan, [2]Nat'l Taitung Univ., Taiwan, [3]Far East Univ., Taiwan*

(P-L2) High Efficiency Blue Phosphorescent Organic Light-Emitting Diode Using Tetraphenylsilane Core Molecule as Host Material
C. -P. Chen[1], C. -H. Huang[1], J. -H. Lee[1], C. -F. Lin[2], T. -L. Chiu[3], M. -K. Leung[1], *[1]Nat'l Taiwan Univ., Taiwan, [2]Nat'l United Univ., Taiwan, [3]Yuan Ze Univ., Taiwan*

(P-L3) High Current Gain Organic Upconversion Device Using Sublimated Chloroaluminum Phthalocyanine as a Charge Generation Layer
Y. -Z. Li[1], C. -J. Shih[1], E. -H. Chen[1], B. -C. Huang[1], C. -C. Lee[1], J. -Y. Guo[2], S. -W. Liu[2], *[1]Nat'l Taiwan Univ. of Sci. and Technol., Taiwan, [2]Ming Chi Univ. of Technol., Taiwan*

(P-L4) Bright Yellow Up-Conversion in a LaOF Containing Er^{3+} and Yb^{3+}
K. Ohyama, T. Nonaka, S. Yamamoto, *Ryukoku Univ., Japan*

TFTp

(P-17) High-Performance Low-Temperature P-Channel Polycrystalline-Germanium Thin-Film Transistors via Continuous Wave Laser Crystallization
C. -Y. Wu, Y. -S. Li, C. -H. Chou, H. -C. Cheng, *Nat'l Chiao Tung Univ., Taiwan*

(P-18) Self-Aligned Metal Double-Gate Junctionless P-Channel Low-Temperature Polycrystalline-Germanium Thin-Film Transistors with a Thin Germanium Channel on a Glass Substrate
A. Hara, Y. Nishimura, H. Ohsawa, *Tohoku Gakuin Univ., Japan*

(P-19) Withdrawn

(P-20) Characteristics of Amorphous In-Ga-Zn-O Thin-Film-Transistors with Channel Layer Deposited by Bias Sputtering
M. Zhang, X. Xiao, X. Ju, X. Zhang, S. Zhang, *Peking Univ., China*

(P-21) Comparison of N_2 and Ar Plasma Treatment for Source/Drain Formation in Self-Aligned Top-Gate Amorphous InGaZnO Thin Film Transistor
H. Lu, C. Ren, X. Xiao, Y. Xiao, C. Wang, S. Zhang, *Peking Univ., China*

(P-22) Oxygen Partial Pressure and Annealing Temperature Influence on the Performance of Back-Channel-Etch Zinc Tin Oxide Thin Film Transistors
Y. Xiao, X. Xiao, L. Zhang, X. Ju, H. Lu, S. Zhang, *Peking Univ., China*

(P-23) Impact of Wet Etchant with Different PH Value on the Performance of Back-Channel-Etch a-IGZO Thin-Film-Transistor
C. Ren, H. Lu, X. Xiao, W. Deng, Y. Xiao, S. Zhang, *Peking Univ., China*

(P-24) 1/f Noise Characteristics of P-Channel Tin Monoxide Thin-Film Transistors
C. -Y. Jeong, H. -J. Kim, J. -H. Lee, S. -D. Bae, H. -I. Kwon, *Chung-Ang Univ., Korea*

(P-25) Light Illumination Effect in AIZTO/IZO Dual-Channel TFTs
H. -S. Choi[1], J. -H. Yang[2], J. H. Choi[2], C. -S. Hwang[2], S. H. Cho[2], S. Jeon[3], *[1]Chosun Univ., Korea, [2]Electronics Telecommunications Res. Inst., Korea, [3]Korea Univ., Korea*

(P-26) Estimation of Threshold Voltage Shift in a-IGZO TFTs under Different Bias Temperature Stress by Improved Stretched-Exponential Equation
X. Ju, X. Xiao, Y. Xiao, S. Zhang, *Peking Univ., China*

(P-27) Enhancement of Gate-Bias and Current Stress Stability of P-Type SnO Thin-Film Transistors with SiN_X/HfO_2 Passivation Layers
S. -M. Hsu[1], Y. -S. Li[1], M. -S. Tu[1], J. -C. He[1], I. -C. Chiu[1], P. -G. Chen[1, 2], M. -H. Lee[2], J. -Z. Chen[1], I. -C. Cheng[1], *[1]Nat'l Taiwan Univ., Taiwan, [2]Nat'l Taiwan Normal Univ., Taiwan*

(P-28) Physics-Based Modeling of Gate-Leakage Current in AlGaN/GaN High Electron Mobility Transistors
X. Ma, F. Yu, W. Deng, J. Huang, *Jinan Univ., China*

(P-29) Withdrawn

(P-30) Correlation between Contact Angle and Electrical Properties in Pentacene and C6-DNT-V-Based Organic Thin Film Transistors
S. Shaari[1, 2], S. Naka[1], H. Okada[1], *[1]Univ., of Toyama, Japan, [2]Univ.Malaysia Perlis, Malaysia*

(P-31) Interface Engineering for Improving the Electrical Stability and Photoelectric Effects of Organic Memory Transistors
Y. -F. Wang, S. -K. Peng, P. -K. Huang, H. -L. Chen, W. -Y. Choua, *Nat'l Cheng Kung Univ., Taiwan*

(P-32) Withdrawn

(P-33) Withdrawn

(P-34) Withdrawn

(P-35) Hybrid-Type Temperature Sensor Using Thin-Film Transistors Generating Rectangle Output Waveform - Operating Confirmation by Actual Experiment -
H. Hayashi, K. Kito, S. Kitajima, T. Hori, T. Matsuda, M. Kimura, *Ryukoku Univ., Japan*

(P-36) Evaluation of the Infrared-Ray Sensors Using Poly-Si TFTs
K. Kito[1], S. Kitajima[1], T. Matsuda[1], M. Kimura[1], M. Tamura[1], M. Inoue[2], *[1]Ryukoku Univ., Japan, [2]Huawei Technologies Japan K.K., Japan*

(P-37) Characteristic Evaluation of Photo-Induced Current by Infrared Light Irradiation in Low-Temperature Poly-Si TFT
S. Kitajima[1], K. Kito[1], T. Matsuda[1], M. Kimura[1], M. Inoue[2], *[1]Ryukoku Univ., Japan, [2]Huawei Technologies Japan K.K., Japan*

(P-38) Investigations on Device Design Parameters of All-Oxide Transparent Charge-Trap Memory Thin-Film Transistors
D. -J. Yun, H. -B. Kang, S. -M. Yoon, *Kyung Hee Univ., Korea*

(P-39) Neural Network Using FPGA for Neurons and IGZO Thin Films for Synapses
Y. Koga[1], T. Matsuda[1], M. Kimura[1,2], *[1]Ryukoku Univ., Japan, [2]Nara Inst. of Sci. and Technol., Japan*

(P-L5) Growth of Single Crystal Stripe in Si Film on Rolled Flexible Substrate by Micro-Chevron-Shaped CW Laser Scanning
W. Yeh, S. Moriyama, *Shimane Univ., Japan*

(P-L6) Highly Stable Top Gate Top Contact ITZO TFT Deposited by Using High Density Plasma Sputtering
J. H. Ahn[1], K. H. Lee[1], J. C. Do[2], W. W. Park[2], S. -H. K. Park[1], *[1]Korea Advanced Inst. of Sci. and Technol., Korea, [2]Advanced Vacuum and Clean Equipment Optimizer, Korea*

(P-L7) Low-Temperature Poly-Si TFTs with Sputtered HfO_2 Gate Stack on Glass Substrate
A. Hara, T. Meguro, *Tohoku Gakuin Univ., Japan*

(P-L8) Electrical Stability of Flexible a-IGZO TFT Under Strained Condition
M. M. Hasan, M. M. Billah, J. Jang, *Kyung Hee Univ., Korea*

TFMDp

(P-40) Formation of nc-Si in SiOx by Flash Lamp Anneling
N. Yoshioka[1], A. Heya[1], N. Matsuo[1], Y. Nakamura[2], G. Yokomori[2], M. Yoshioka[2], K. Kohama[3], K. Ito[3], *[1]Univ. of Hyogo, Japan, [2]USHIO INC., Japan, [3]Osaka Univ., Japan*

(P-41) Large-Grain Sn-Doped Ge (100) on Insulator by Aluminum-Induced Crystallization at Low-Temperature for Flexible Electronics
M. Sasaki, M. Miyao, T. Sadoh, *Kyushu Univ., Japan*

(P-42) High Optical Conversion Capability within the Interface between Graphene and Si under Zero Bias and Visible to Near Infrared Regime
C. -C. Hsiao[1], M. -Q. Wei[1], T. -T. Ren[1], B. -Y. Chen[2], M. -Y. Li[2], J. -M. Liou[2], F. -H. Ko[1], Y. -S. Lai[2], *[1]Nat'l Chiao Tung Univ., Taiwan, [2]Nat'l Nano Device Labs., Taiwan*

(P-43) Study on Graphene Formation by Hot Mesh Deposition
S. Fuji, A. Heya, N. Matsuo, *Univ. of Hyogo, Japan*

(P-44) Investigation of the Effects of Mg Incorporation into Solution-Processed InZnO Semiconductor Thin Films for UV Photodetectors
C. -Y. Tsay, P. -H. Wu, *Feng Chia Univ., Taiwan*

(P-45) Thickness Effect of IGZO Layer in Light-Addressable Potentiometric Sensor
C. -H. Chen, C. -M. Yang, L. -B. Chang, C. -S. Lai, *Chang Gung Univ., Taiwan*

(P-46) Investigation of Electrical Characteristics of Multi-Thin-Film Metal Electrodes Deposited on Flexible Polydimethylsiloxane Substrates by Using an Automatic Folding Test System
P. -C. Wang[1], B. -J. Wen[2], T. -Y. Lee[1], P. -H. Hung[2], H. Y. Chen[3], *[1]Nat'l Tsing Hua Univ., Taiwan, [2]Nat'l Taiwan Ocean Univ., Taiwan, [3]Industrial Technol. Res. Inst., Taiwan*

(P-L9) Multi-Functional Touch Sensors with Strained P(VDF-TrFE) Deposited on Metal Oxide Thin Film Transistor
T. Jin[1], J. Ryu[1], H. S. Kang[2], K. No[1], S. -H. K. Park[1], *[1]Korea Advanced Inst. of Sci. and Technol., Korea, [2]LG Display, Korea*

(P-L10) All-Solid-State Electrochromic Device Integrated with Near-IR Blocking Layer for Image Sensor and Energy-Saving Glass Application
M. -C. Wang, Y. -C. Chen, M. -H. Hsieh, W. -F. Tsai, D. -J. Jan, *Inst. of Nuclear Energy Res., Taiwan*

(P-L11) Performance Enhancement of Pt/ZnO/Pt Resistive Random Access Memory (RRAM) with UV-Ozone Treatment
D. -L. Chen[1], H. -C. Yu[1], C. -C. Yang[1], Y. -K. Su[1,2], C. -W. Chou[1], J. -L. Ruan[3], *[1]Nat'l Cheng Kung Univ., Taiwan, [2]Kun Shan Univ., Taiwan, [3]Nat'l Chung Shan Inst. of Sci. and Technol., Taiwan*

PVp

(P-47) Numerical Modeling of Device Structure for FeS_2 Thin Film Solar Cells
S. Uchiyama, Y. Ishikawa, Y. Kawamura, Y. Uraoka, *Nara Inst. of Sci. and Technol., Japan*

(P-48) High Photothermal Properties in Silicon Nanostructures
T. -T. Ren[1], M. -Q. Wei[1], C. -C. Hsiao[1], B. -Y. Chen[2], M. -Y. Li[2], J. -M. Liou[2], F. -H. Ko[1], Y. -S. Lai[2], *[1]Nat'l Chiao Tung Univ., Taiwan, [2]Nat'l Applied Res. Labs., Taiwan*

(P-49) Improving Optical and Electrical Properties of Micropillar and Black-Si Solar Cells by Combining Them into a Superstructure
J. Shieh, C. Y. You, J. M. Liu, C. C. Chiu, *Nat'l United Univ., Taiwan*

(P-50) Doping Profile Control of Epitaxial-Like Si Emitting Layer for the Application of c-Si Solar Cells
C. -C. Lee, Y. -L. Hsieh, T. T. Li, J. -Y. Chang, *Nat'l Central Univ., Taiwan*

(P-51) Microwave Rapid Heating Used for Diffusing Impurities in Silicon
K. Ota[1], S. Kimura[1], M. Hasumi[1], A. Suzuki[2], M. Ushijima[2], T. Sameshima[1], *[1]Tokyo Univ. of Agriculture and Technol., Japan, [2]Tokyo Electron Limited, Japan*

(P-52) Dye Sensitized Solar Cells with Carbon Mixed Conducting Polymer Counter Electrodes
C. -F. Lin[1], C. -L. Chen[1], P. -H. Chen[1], H. -C. Han[2], K. -Y. Chiu[3], Y. O. Su[3], *[1]Nat'l United Univ., Taiwan, [2]Res. Ctr. for Applied Sci., Taiwan, [3]Nat'l Chi Nan Univ., Taiwan*

(P-53) Gallium-Doped Zinc Oxide Films as Transparent and Conductive Substrates Applying in Dye-Sensitized Solar Cell
C. Li, S. Hou, *Kochi Univ. of Technol., Japan*

(P-54) Sol-Gel Process ZnO Thin Film as the Electron Transport Layer in Inverted Polymer Solar Cell
M. -Y. Chang, C. -C. Lin, C. -K. Huang, *Nat'l Sun Yat-Sen Univ., Taiwan*

(P-55) ITO-Free Inverted Small Molecule Solar Cells
M. -Y. Lin[1], S. -H. Wu[2], Y. -L. Kang[3], Y. -C. Chang[2], C. -W. Chu[2], *[1]Chung Yuan Christian Univ., Taiwan, [2]Res. Ctr. of Applied Sci., Taiwan, [3]Nat'l Taiwan Univ., Taiwan*

(P-56) Effects of Molybdenum Trioxide Thickness of Organic Photovoltaic with Silver Anode
C. -L. Lin[1], T. -L. Chiu[1], C. -H. Chen[2], C. -F. Lin[3], J. H. Lee[2], *[1]Yuan Ze Univ., Taiwan, [2]Nat'l Taiwan Univ., Taiwan, [3]Nat'l United Univ., Taiwan*

(P-57) Fully Printable Mesoscopic Perovskite Solar Cells; Effect of NiO Layer on the Device Performance
N. Peiris[1,2], G. Mizuta[1], H. Kanda[1], T. Nishina[1], S. Ito[2], H. Segawa[1], *[1]The Univ. of Tokyo, Japan, [2]Univ. of Hyogo, Japan*

(P-58) Investigation of High Efficiency Methyl Ammonium Lead Halide Perovskite-Si Tandem Solar Cell
S. M. Iftiquar, J. Yi, *Sungkyunkwan Univ., Korea*

(P-59) Perovskite/P-Type Crystal Silicon Tandem Solar Cells
H. Kanda[1], A. Uzum[1], H. Nishino[2], S. Ito[1], *[1]Univ. of Hyogo, Japan, [2]Osaka Gas Corp., Japan*

(P-L12) Low-Pressure Hybrid Chemical Vapor Deposition for Efficient Perovskite Solar Cells and Module
M. -H. Li, P. -S. Shen, J. -S. Chen, Y. -H. Chiang, P. Chen, T. -F. Guo, *Nat'l Cheng Kung Univ., Taiwan*

Special Session : New Driving Technologies
(9 : 15 ～ 10 : 25)
Chairpersons : R. Hattori, *Kyushu Univ., Japan*
M. Mitani, *Sharp Corp., Japan*

9 : 15 (SP-1) In-Cell Capacitive Touch Panel Structures and Their Readout Circuits (Invited)
S. -H. Lee, J. -S. An, S. -K. Hong, O. -K. Kwon, *Hanyang Univ., Korea*

9 : 40 (SP-2) High-Definition In-Cell Touch Panel with Parallel Scanning Method (Invited)
K. Tada, K. Kida, S. Yamagishi, T. Maruyama, J. Mugiraneza, Y. Sugita, H. Kawamori, T. Saitoh, H. Shioe, *Sharp Corp., Japan*

10 : 05 (SP-3) Blue-Phase Pixel Circuit Design to Enlarge Operation Voltage and Combine Polarity Inversion with a-IGZO Thin-Film-Transistors
C. -E. Wu, C. -L. Lin, M. -X. Wang, *Nat'l Cheng Kung Univ., Taiwan*

― *Coffee Break* ―

Session 4 : High-Performance TFTs (10 : 40 ～ 11 : 50)
Chairpersons : M. -H. Yoon, *Gwangju Inst. of Sci. and Technol., Korea*
S. Horita, *JAIST, Japan*

10 : 40 (4-1) Understanding of Carrier Transport in High-Performance Solid Phase Crystallized Poly-Si Nano-Wire Transistors (Invited)
M. Oda, K. Sakuma, Y. Kamimuta, M. Saitoh, *Toshiba Corp., Japan*

11 : 05 (4-2) Radio Frequency Electronics in a-IGZO TFT Technology (Invited)
K. Ishida[1], T. Meister[1], R. Shabanpour[1], B. K. Boroujeni[1], C. Carta[1], G. Cantarella[2], L. Petti[2], N. Münzenrieder[2,3], G. A. Salvatore[2], G. Tröster[2], F. Ellinger[1], *[1]Technische Universität Dresden, Germany, [2]Swiss Federal Inst. of Technol., Switzerland, [3]Univ. of Sussex, United Kingdom*

11 : 30 (4-3) Ultrahigh-Performance Poly-Si Thin Film Transistor Using Multi-Line Beam Continuous-Wave Laser Lateral Crystallization
T. T. Nguyen, M. Hiraiwa, T. Hirata, S. Kuroki, *Hiroshima Univ., Japan*

― *Lunch* ―

Session 5 : Perovskite Photovoltaics (13: 00 ～ 13 : 40)
Chairpersons : C. Li, *Kochi Univ. of Technol., Japan*
T. Miyadera, *AIST, Japan*

13 : 00 (5-1) Laser Deposition for the Controlled Co-Deposition of Organolead Halide Perovskite
T. Miyadera, T. Sugita, H. Tampo, K. Matsubara, M. Chikamatsu, *Nat'l Inst. of Advanced Industrial Sci. and Technol., Japan*

13 : 20 (5-2) Internal Resistance of Perovskite Solar Cells under Low Illuminance Conditions
I. Raifuku[1], Y. Ishikawa[1], S. Ito[2], Y. Uraoka[1], *[1]Nara Inst. of Sci. and Technol., Japan, [2]Univ. of Hyogo, Japan*

Session 6 : Advanced Processing and Devices
(13: 40 ～ 14 : 20)
Chairpersons : Y. Wang, *Univ. of Maryland, USA*
T. Matsuda, *Ryukoku Univ., Japan*

13 : 40 (6-1) Surface Passivation of Crystalline Silicon by Heat Treatment in Liquid Water
T. Motoki[1], K. Yasuta[1], H. Suzuki[1], T. Nakamura[1], M. Hasumi[1], T. Sameshima[1], T. Mizuno[2], *[1]Tokyo Univ. of Agriculture and Technol., Japan, [2]Kanagawa Univ., Japan*

14 : 00 (6-2) Electroluminescence Emission Patterns of Organic Light-Emitting Transistors Based on Crystallized Fluorene-Type Polymers
H. Kajii, T. Ohtomo, Y. Ohmori, *Osaka Univ., Japan*

― *Coffee Break* ―

Session 7 : Basic Properties of Oxide TFTs

(14 : 35 ～ 15 : 40)

Chairpersons : K. Ishida, *Technische Universitaet Dresden, Germany*
Y. Terai, *JOLED, Japan*

14 : 35 (7-1) High Mobility SnO_2 TFT for Display and Future IC (Invited)
A. Chin[1], C. W. Shih[1], C. F. Lu[2], W. F. Su[2], *[1]Nat'l Chiao Tung Univ., Taiwan, [2]Nat'l Taiwan Univ., Taiwan*

15 : 00 (7-2) Why High-Pressure Sputtering must be Avoided to Deposit a-In-Ga-Zn-O Films
K. Ide, M. Kikuchi, M. Sasase, H. Hiramatsu, H. Kumomi, H. Hosono, T. Kamiya, *Tokyo Inst. of Technol., Japan*

15 : 20 (7-3) Comparative Study on Light-Induced Negative-Bias Stress Stabilities in Amorphous In-Ga-Zn-O Thin Film Transistors with Photoinduced Transient Spectroscopy
K. Hayashi, M. Ochi, A. Hino, H. Tao, H. Goto, T. Kugimiya, *Kobe Steel, Japan*

Closing Remarks (15 : 40 ～ 15 : 45)

Author Interviews (15 : 45 ～ 16 : 15)

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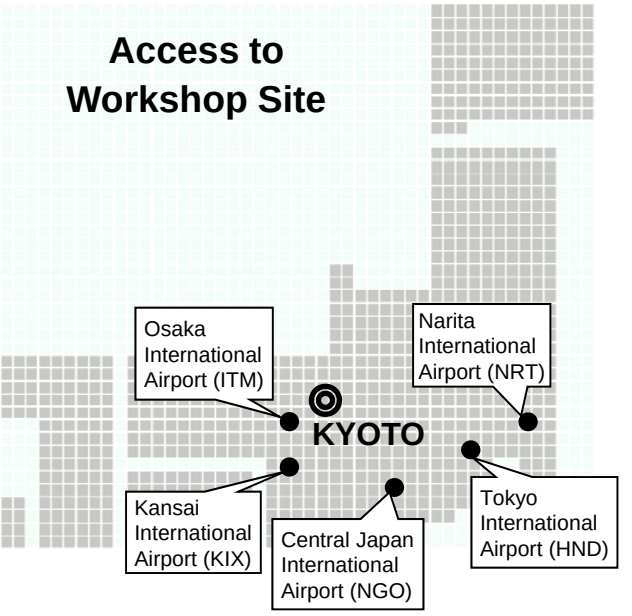

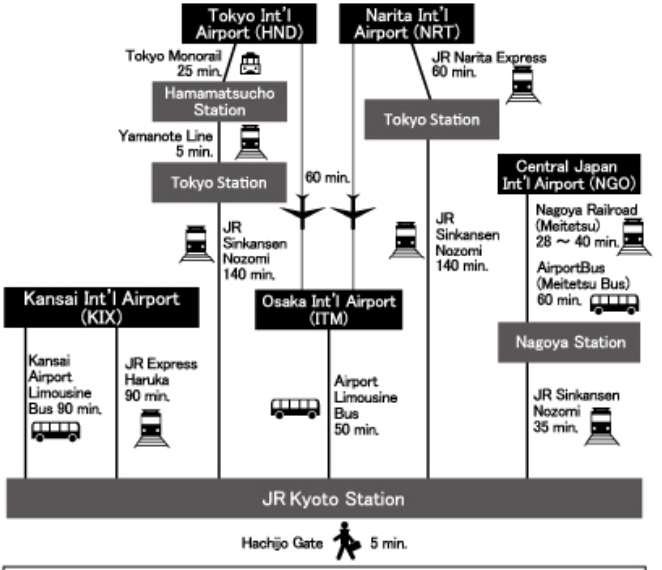

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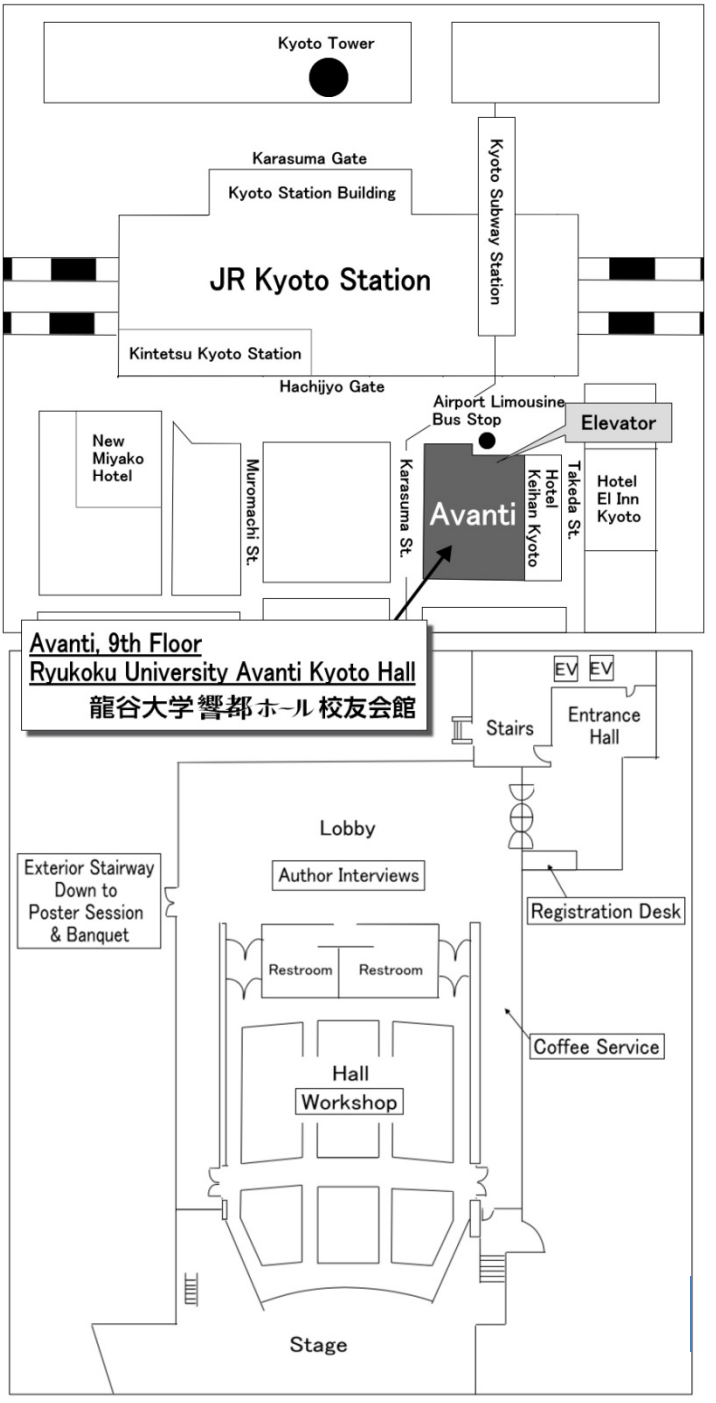
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