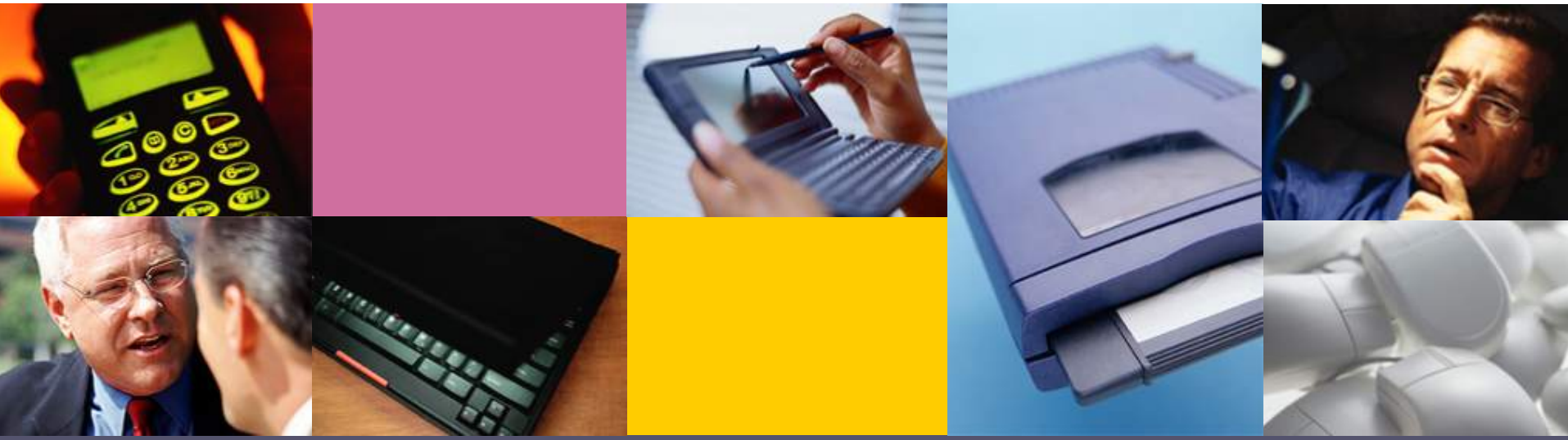
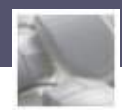
TFT-LCD 產業介紹

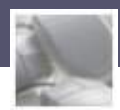


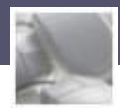
Outline

光電產業是政府「兩兆雙星計畫」指定扶植發展的產業。市場調查機構「Display Search」在2007年第2季調查報告指出，台灣已連續三年出貨佔有率超越南韓，躍升TFT-LCD領先地位。，實現了經濟部在 2002 年提出之「兩兆雙星產業發展計畫」， 工業局表示， TFT-LCD面板業者，包括友達、奇美及華映等7.5代以上面板廠總計投資達七千億元，更顯示TFT-LCD產業已成爲台灣重要經濟發展指標之一，因此對TFT-LCD之生產技術、產業發展的了解有其必要性。

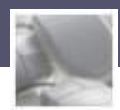
Contents

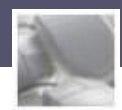
個人簡介

Reporter Introduction

- 元智大學工業工程與管理研究所畢業
- 工作經歷：Motorola Crystal …2 years
  仁寶電腦 NB …4 years
- 目前服務於統寶光電 TFT-LCD …5 years

TPO Introduction

~統寶光電(TPO)~

統寶光電是由科技產業界的兩大領導廠商-統寶光電及飛利浦MDS於2006年6月合作成立，專攻中小尺寸面板的領域。

在統寶光電及飛利浦MDS的綜效結合下所產生的統寶光電具有最佳的的優勢統寶光電在低溫多晶矽(LTPS-Low Temperature Poly Silicon)及AMOLED TFT LCD面板製造技術的發展上被視為是全球的先驅廠商。具有成熟、完整的的產品設計及研發能力，現在統寶光電在通訊、消費性電子、汽車及航空的領域提供具競爭性及高附加價值的產品及技術組合，達成客戶最大滿意度。

目前統寶光電總部設立於台灣竹南，是世界最大的中小尺寸TFT面板製造商之一，員工人數為15,400人。國際行銷網藉由全球超過15個銷售點，遍及亞洲、歐洲及美洲等11個國家。

負責人: 陳瑞聰

資本額: 約NT$422億

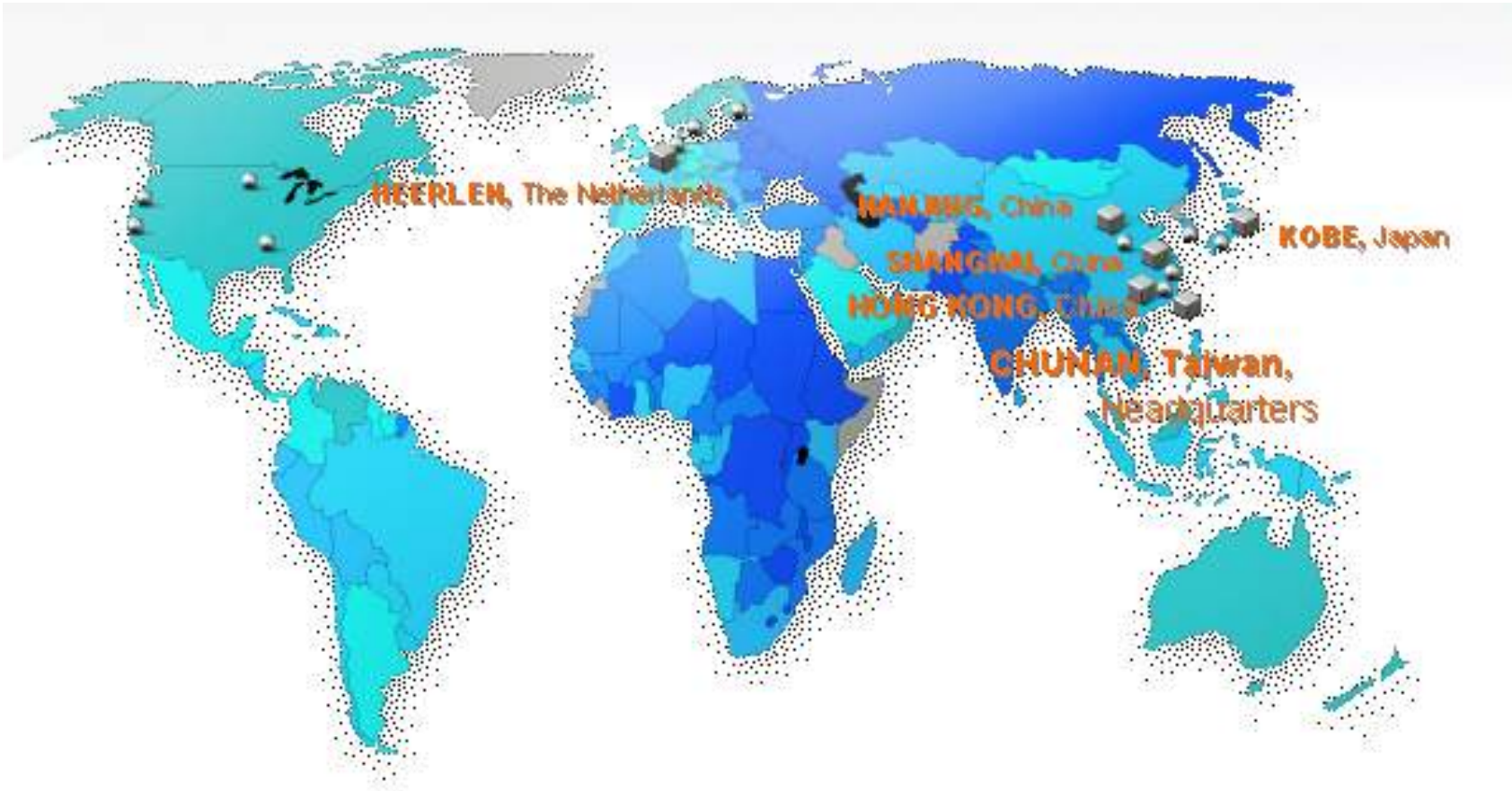
員工人數: 約15400人

全球總部:

苗栗縣竹南鎮科中路12號(新竹科學園區第四期)

公司網址:http://www.tpo.biz

TPO Global Reach



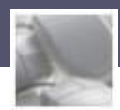
Worldwide sales offices and sales representatives

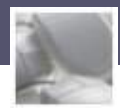
Europe –Germany; Espoo, Finland and Heerlen, The Netherlands

Asia –Shanghai, Beijing and Hong Kong (P.R.C.); Taipei and Chunan, Taiwan; Seoul, Korea; and Tokyo(Yokohama), Japan

United States – Cupertino and San Diego, California; Farmington Hills, Michigan; and Chicago, Illinois

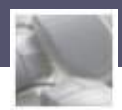
Market Focus

顯示器簡介

Display History

Physical Display

VFD來客顯示器

3M Micro display

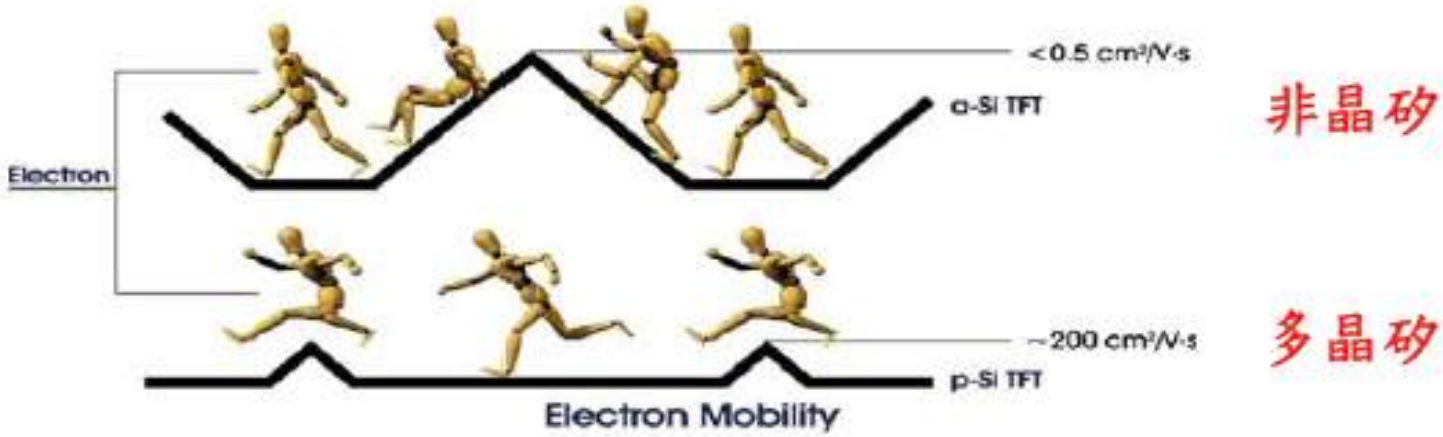
LED TV Wall

26” FED 顯示器

DLP曲面顯示器

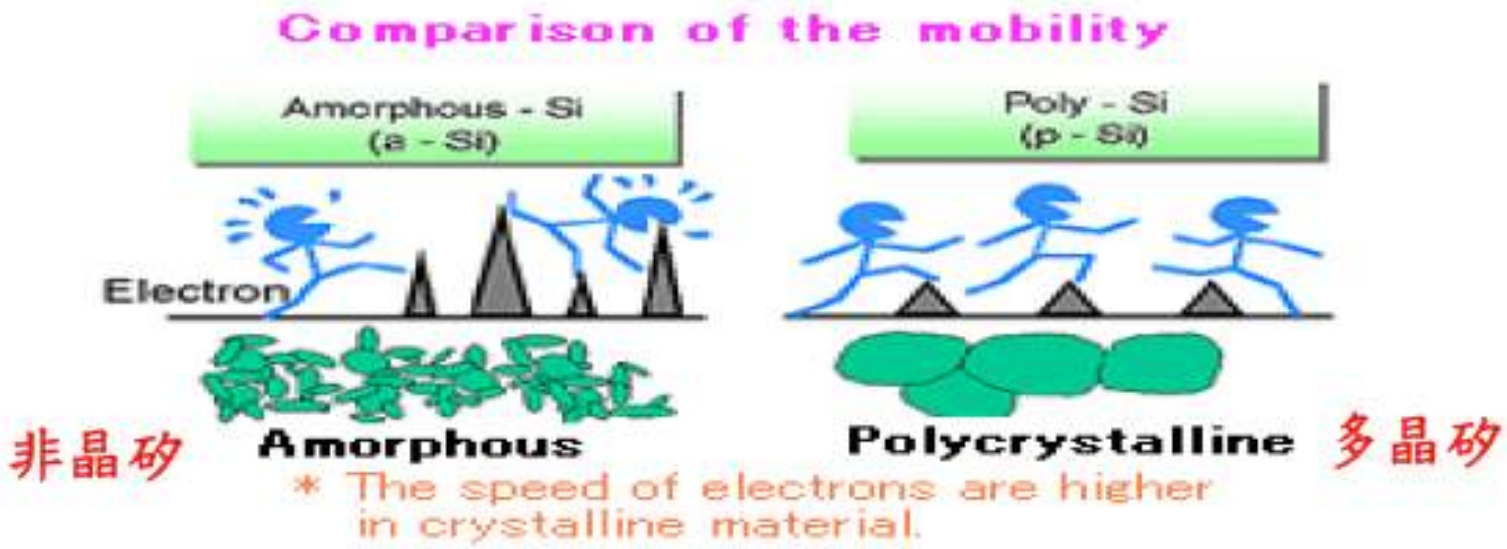
Picture Quality

Comparison of LTPS and a-Si TFT

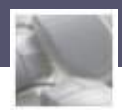


非晶矽

多晶矽

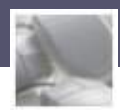


TFT-LCD SPEC (Resolution)

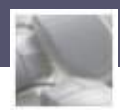
- 液晶顯示器由很多個紅（R）、綠（G）、藍（B）色的次畫素（sub-pixel）所構成，R+G+B合稱爲一個畫素。
- 例如，Full HD解析度1920x1080表示橫向有1920個畫素，縱向有1080個畫素。解析度高的顯示器有能力顯示更細緻的畫質及對應各種高畫質訊號的來源，太低的解析度會使畫面有顆粒感。
- 1080i與1080p有何差異？數字代表的是相對掃瞄線數，數字後面的「i」是交錯掃描(interlace)，「p」表示循序掃描(Progressive)。1080i表示以奇偶數掃描線交錯方式呈現畫面，1080p表示以全掃描線方式顯示完整畫面。所以1080p的畫面會比1080i更流暢、穩定、不閃爍。

TFT-LCD SPEC (Brightness)

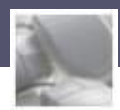
- 液晶螢幕亮度單位爲cd/m2 ，表示顯示器明亮的程度。
- 顯示器的亮度以人眼覺得舒服爲原則，太亮或太暗都不好。一般而言，觀看距離越遠或是所處的環境越明亮，需要亮度較高的顯示器。在一般客廳環境下，電視的亮度至少必須達到500 cd/m2。

TFT-LCD SPEC (Contrast Ratio)

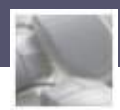
- 對比，指的就是顯示器中白色亮度與黑色亮度的比值。顯示器如果能讓亮的部份更亮，黑的部份更黑，就表示能讓圖像更加鮮明銳利。 所以對比值越高的液晶顯示器，意味著畫面更加銳利清晰，挑選液晶電視時，最好要少要擁有1200:1以上標準。

TFT-LCD SPEC (Color Saturation)

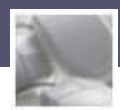
- 「色彩飽和度」即爲螢幕顯示顏色的能力，而色彩飽和度規格則是以「NTSC百分比」來表示，目前一般電視的色彩飽和度約爲92%NTSC。對消費者來說，色彩飽和度越高當然就代表畫面越鮮豔亮麗。

TFT-LCD SPEC (Color Depth)

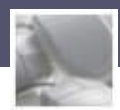
- 色彩深度，用來表現各種數位顏色時所使用的位元數。目前主流液晶顯示器之規格爲8 bits，可顯示1千6百萬種色階，更高階顯示器 爲10 bits，可顯示10億7千萬色階。

TFT-LCD SPEC (Response Time)

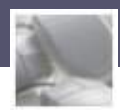



- 液晶螢幕的反應時間以「ms（毫秒）」爲單位，秒數越少代表反應時間越快，畫面也相對更爲流暢。
- 目前主流液晶顯示器最少需要有小於6ms的反應能力。不過DVD、高畫質數位電視訊號及高畫質電腦遊戲動畫的需求日益增加，因此需要反應速度更快的液晶顯示器來搭配使用。

TFT-LCD SPEC (Viewing Angle)

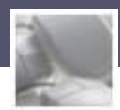



- 舊式液晶螢幕經常被人探討的問題就是「視角限制」，須在螢幕正前方才能看得清楚畫面，左右偏離時對比或顏色或亮度會失真。針對這樣的問題，TFT-LCD廠商開發了各式各樣的廣視角技術，包括TN +Film、MVA、IPS等等。
- 規格表上的視角數據，有些以上下左右的四個角度分別標示，也有以上下和左右視角的總和標示，一般要求上下左右視角分別能大於80度以上（CR>10），才能算是液晶電視標準規格。消費者比較液晶電視產品時，可調整欣賞角度便能看出各家產品在視角限制技術上的不同。事實上，各家廠商對視角的定義及測試基準的不同，消費者需注意不能只看廠商的標示便認爲角度越大就是越好。

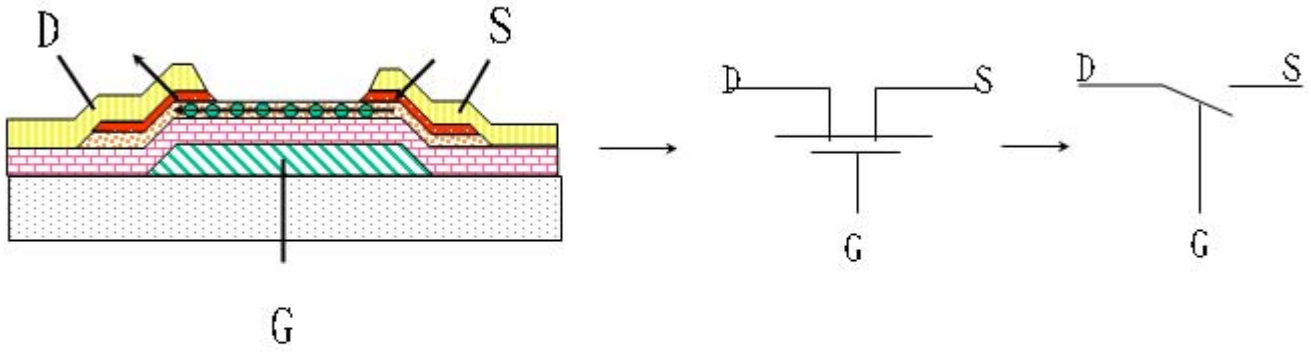



TFT-LCD基礎簡介

Acronym

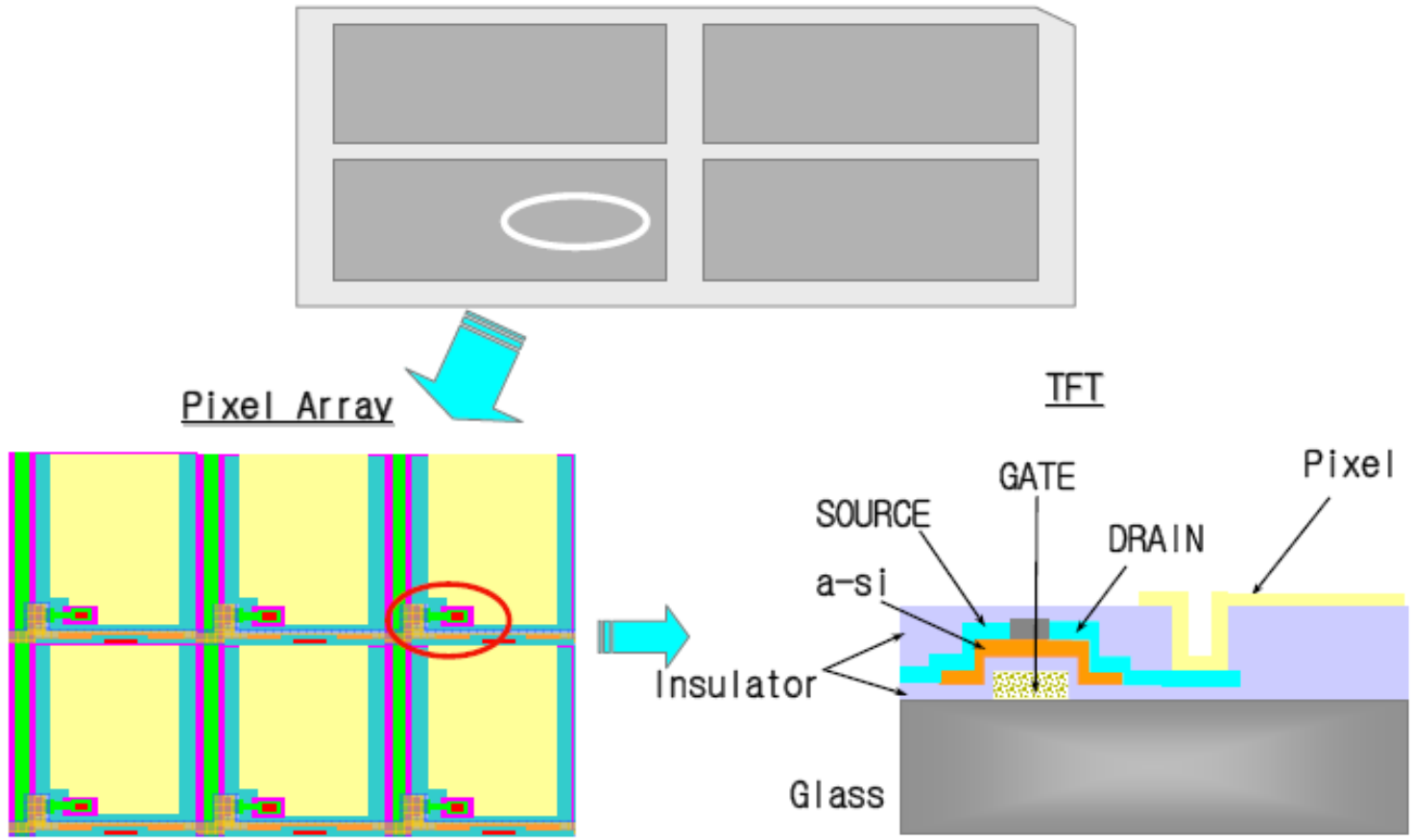



- **TFT-LCD**
  (Thin Film Transistor-Liquid Crystal Display)
  薄膜電晶體-液晶顯示器



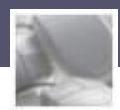
1. TFT為一三端子元件。
2. 在LCD的應用上可將其視為一開關。

Where the TFT



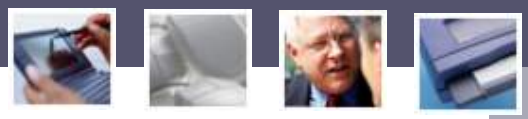
資料來源:光機電奈米量測系統科技整合研討會

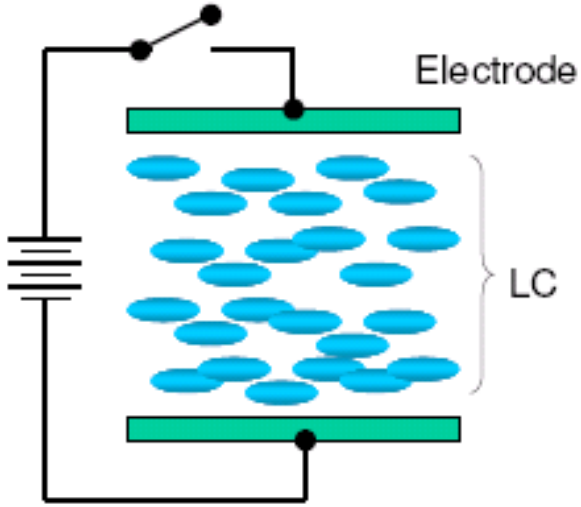
Acronym

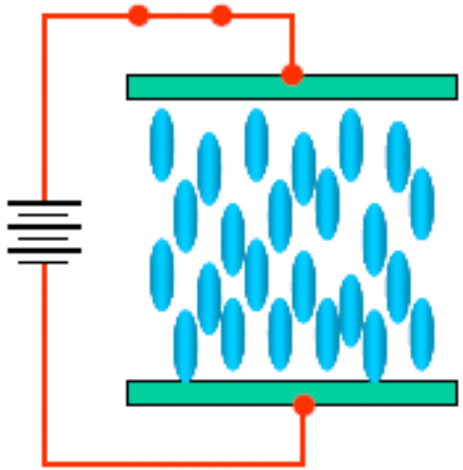
- **LC**
  (Liquid Crystal)
  此一物質介於固態和液態之間，具有液態流動與光學異向性的物體命名爲「液態晶體」， 這就是「液晶」的由來，能利用外部增加電場來驅使液晶排列狀態改變至其他方向，造成光線穿過液晶時的光學特性發生改變。

LC Operation Theory



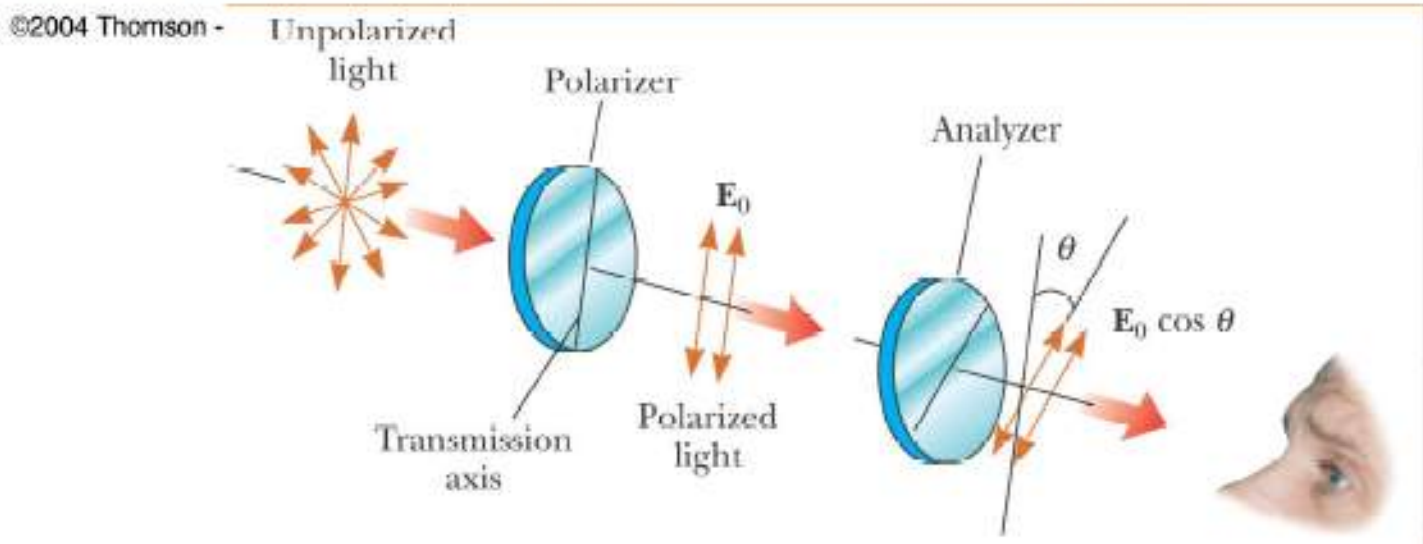


Field OFF

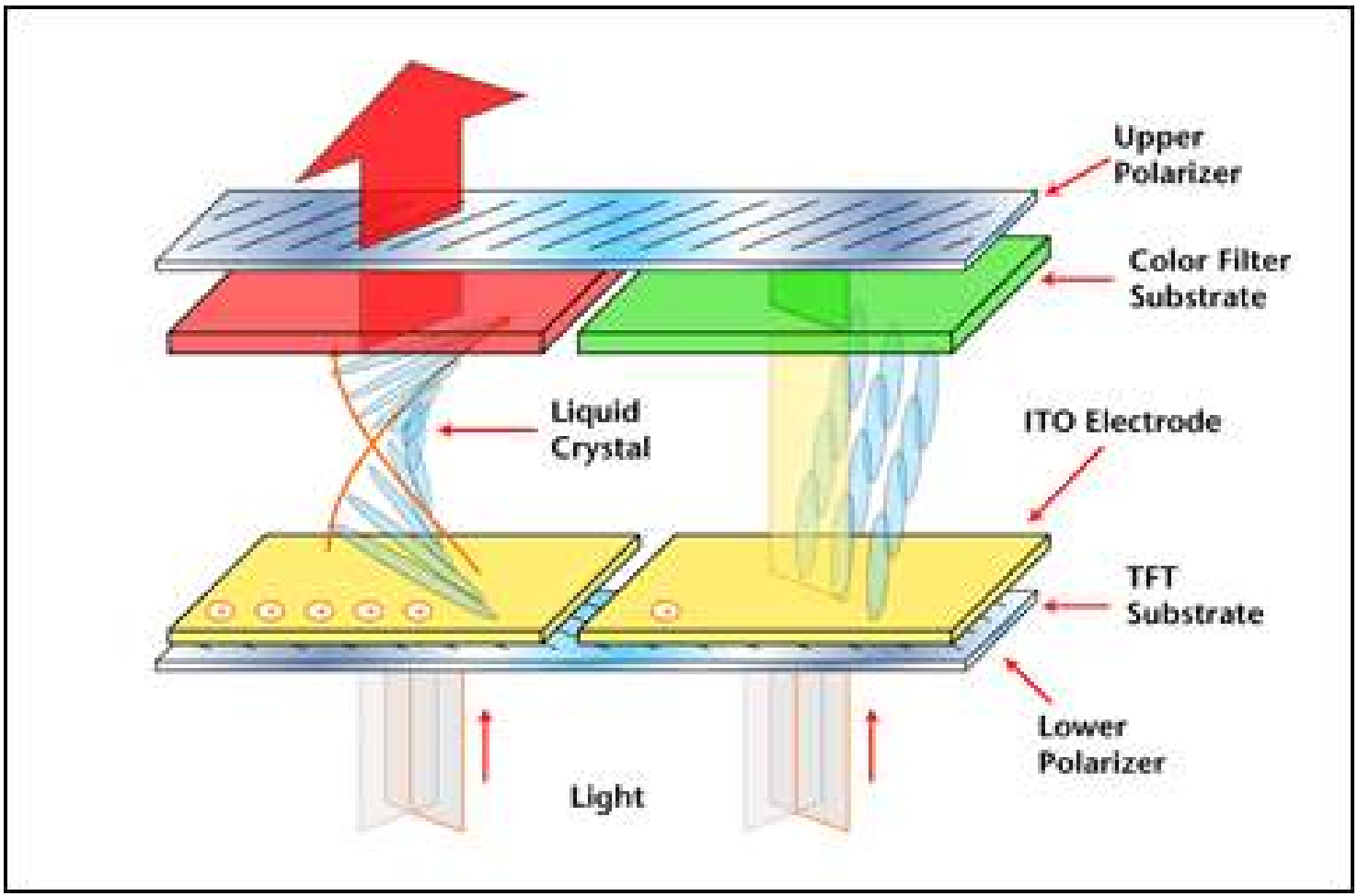


Field ON

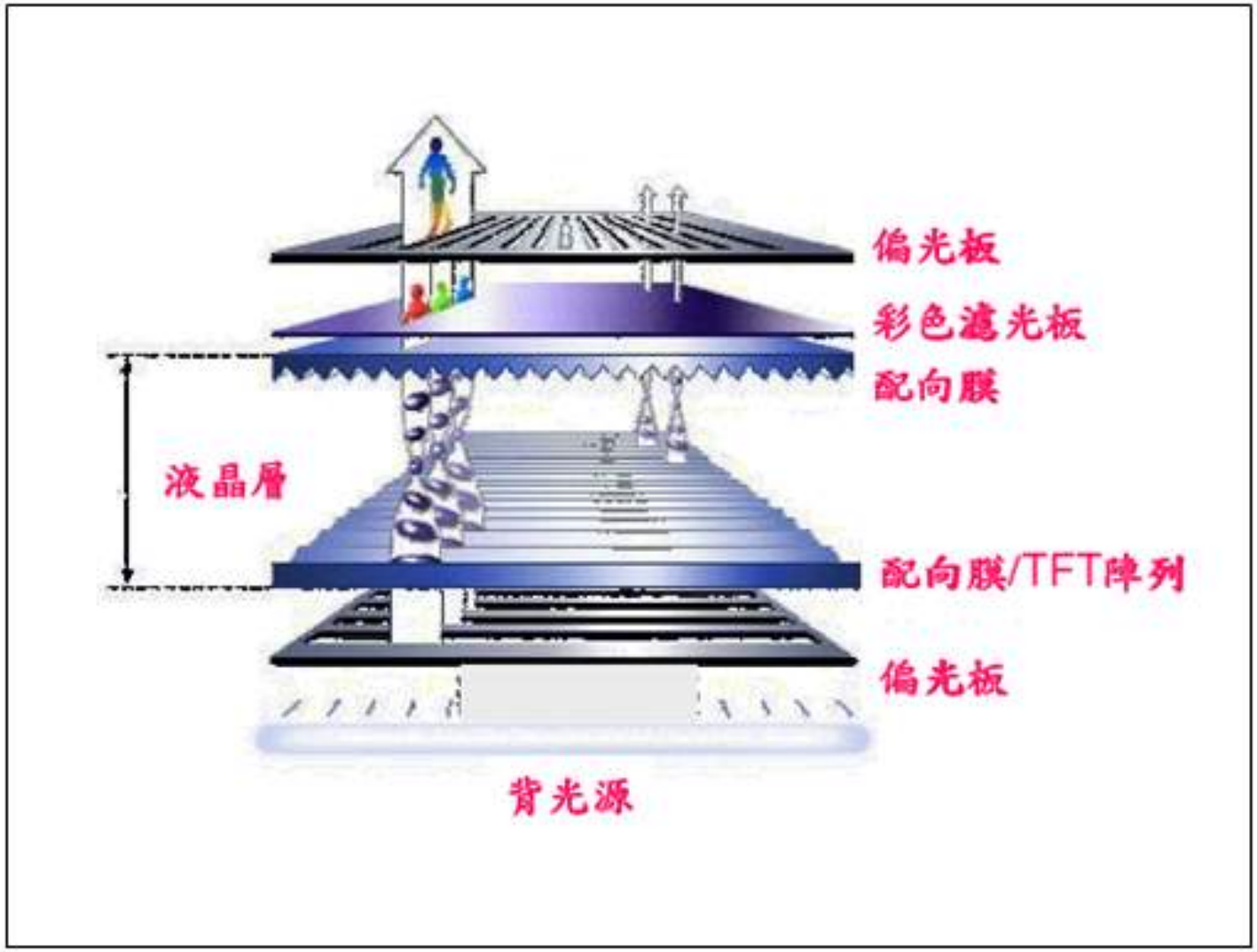
Malus's Law

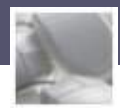

©2004 Thomson -
Unpolarized light
Polarizer
Analyzer
E_0
θ
$E_0 \cos \theta$
Transmission axis
Polarized light

TFT-LCD Operation Theory



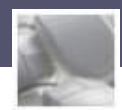
TFT-LCD Structure

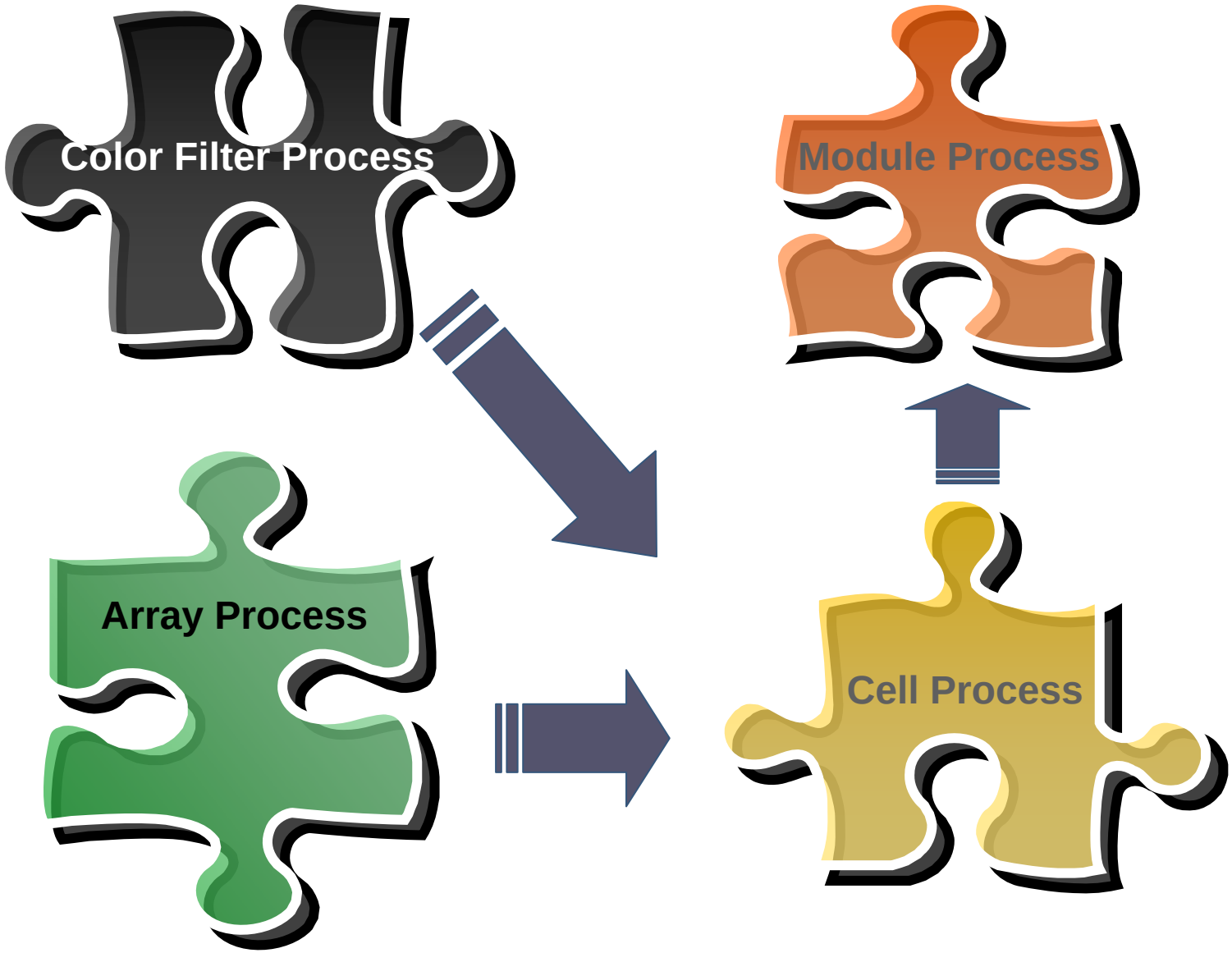


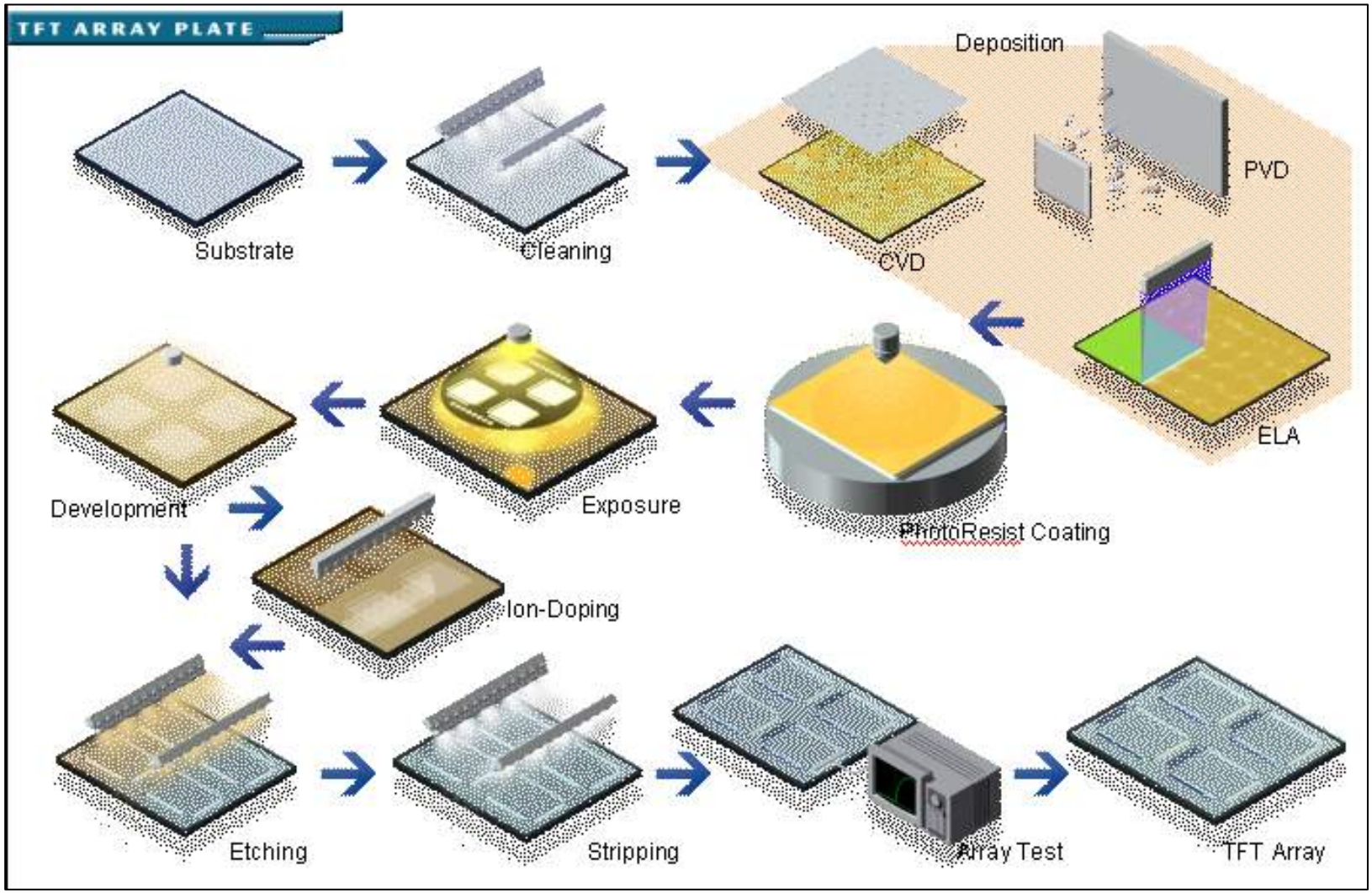
TFT-LCD製程簡介

TFT-LCD Major Process

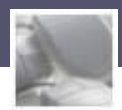



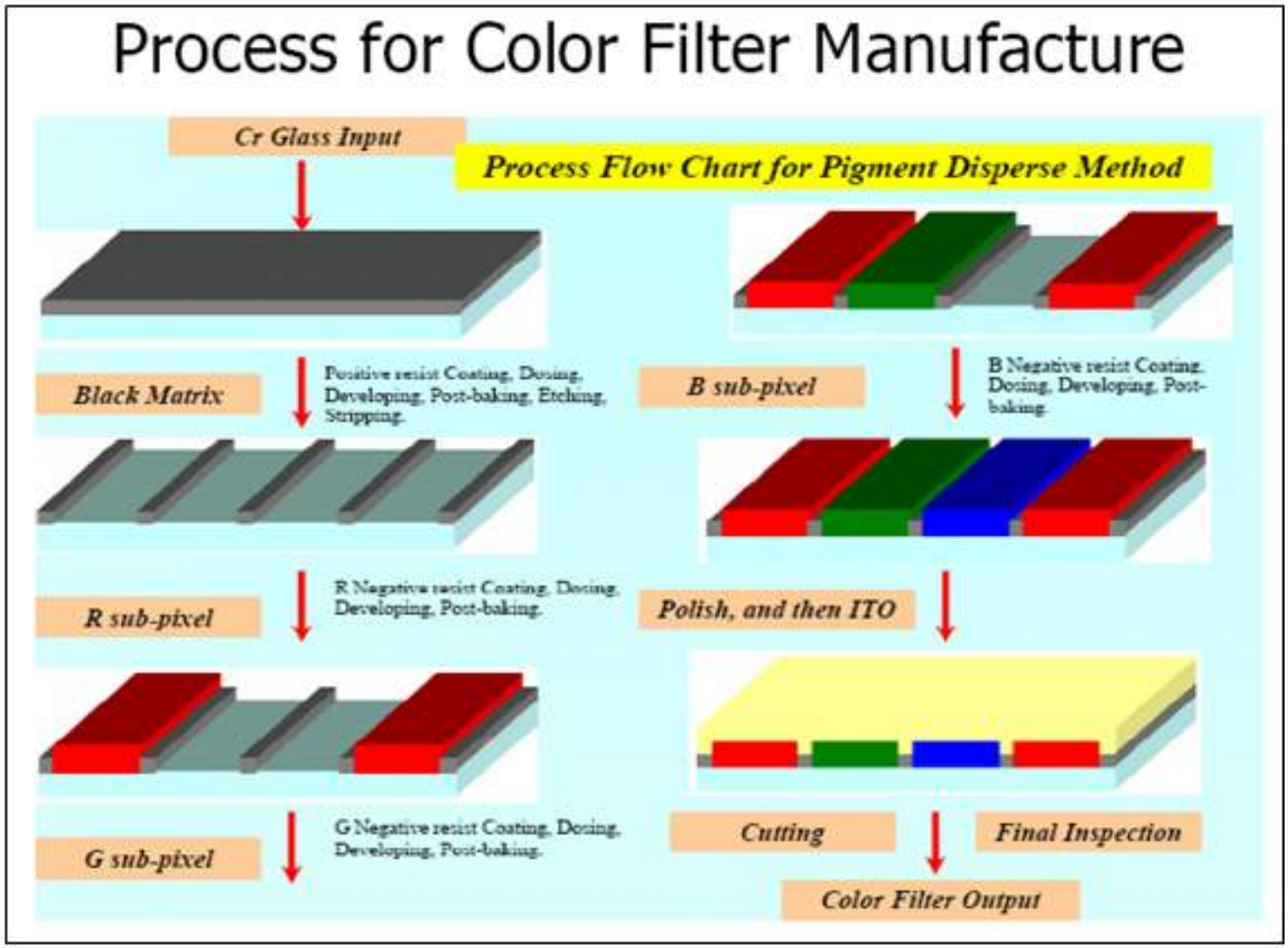


Array Process

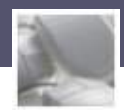


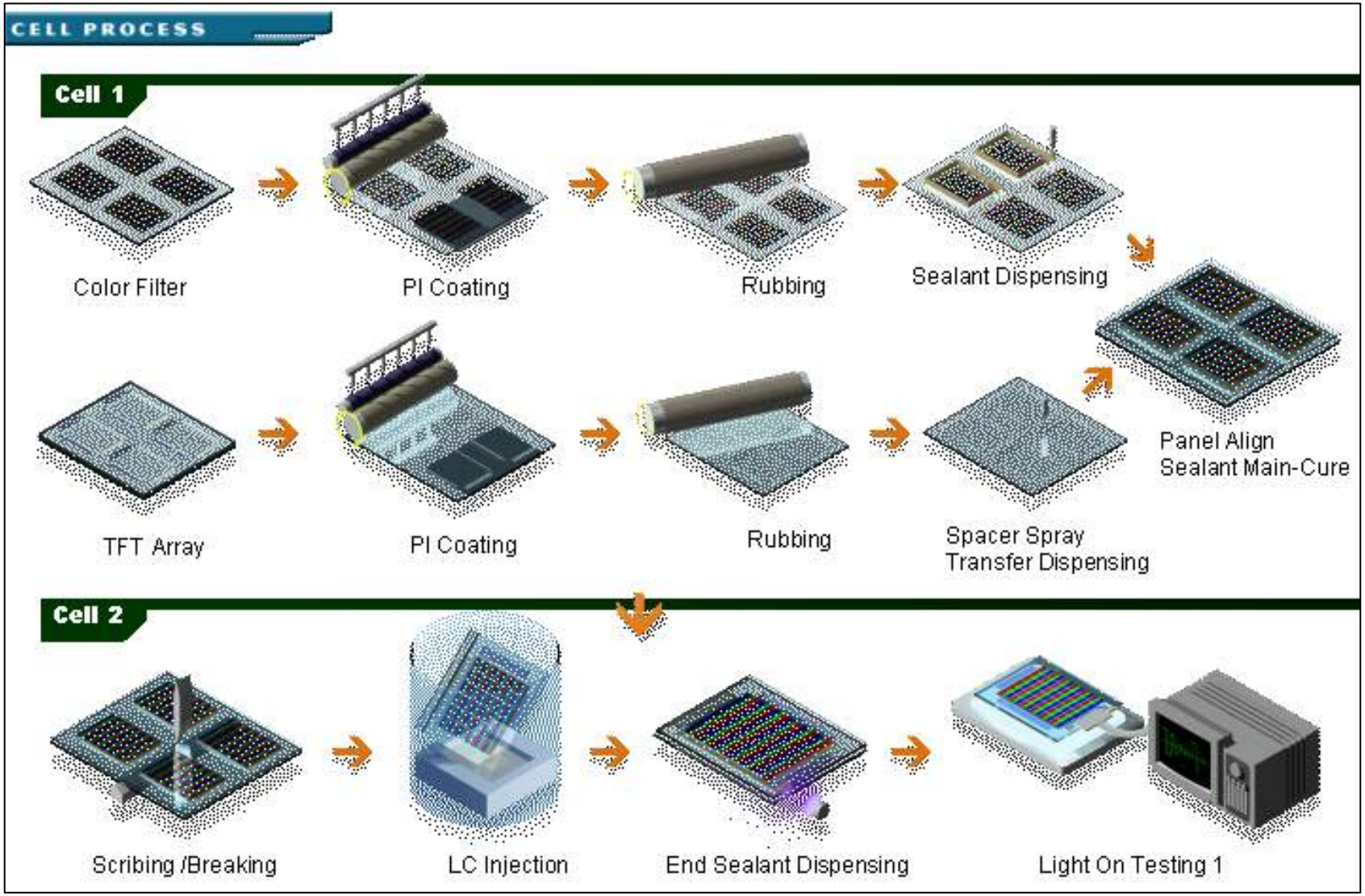
Color Filter Process

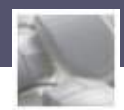


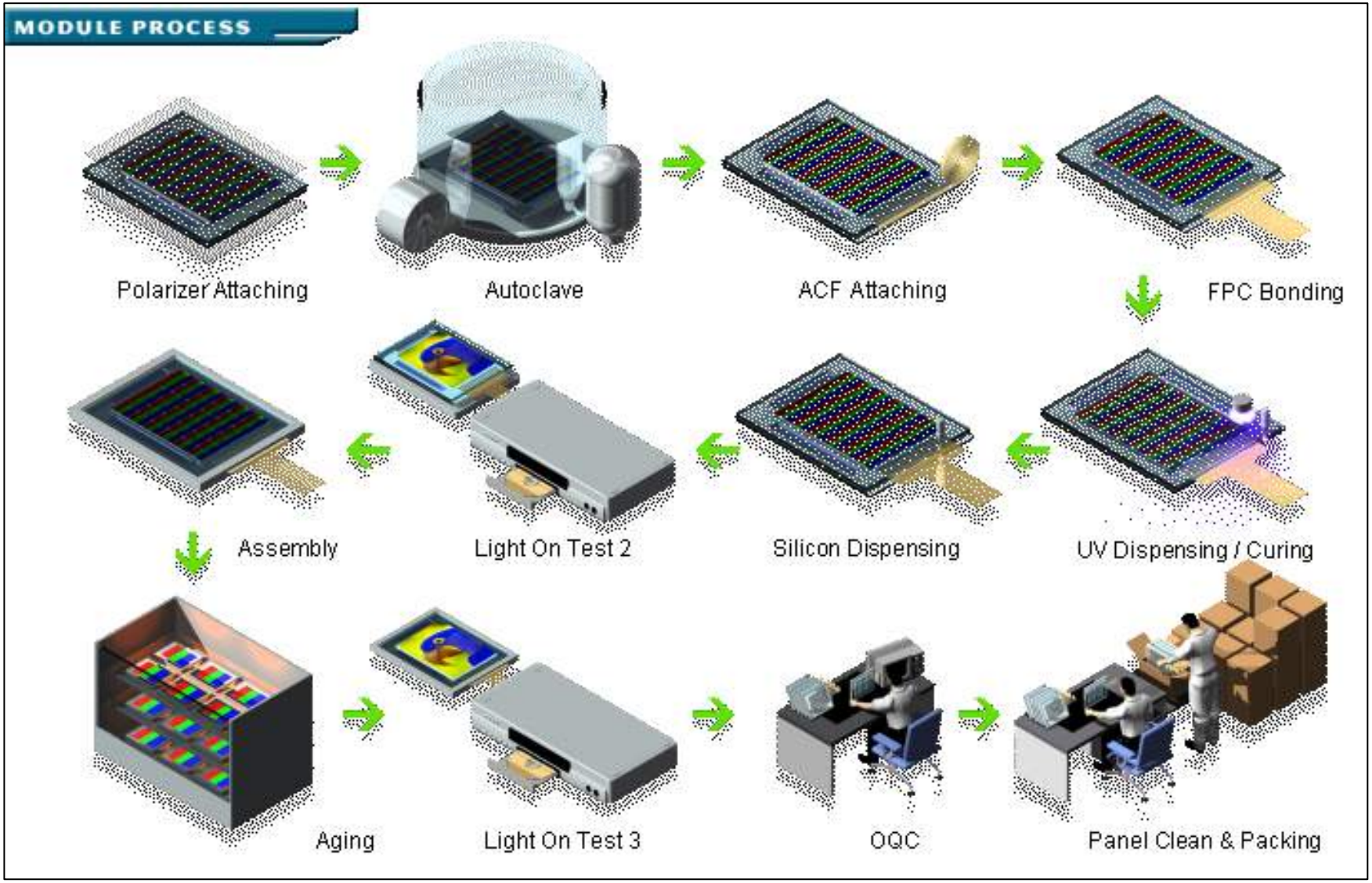
Cell Process



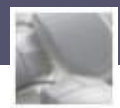
Module Process



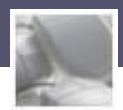
TFT-LCD Production Animation

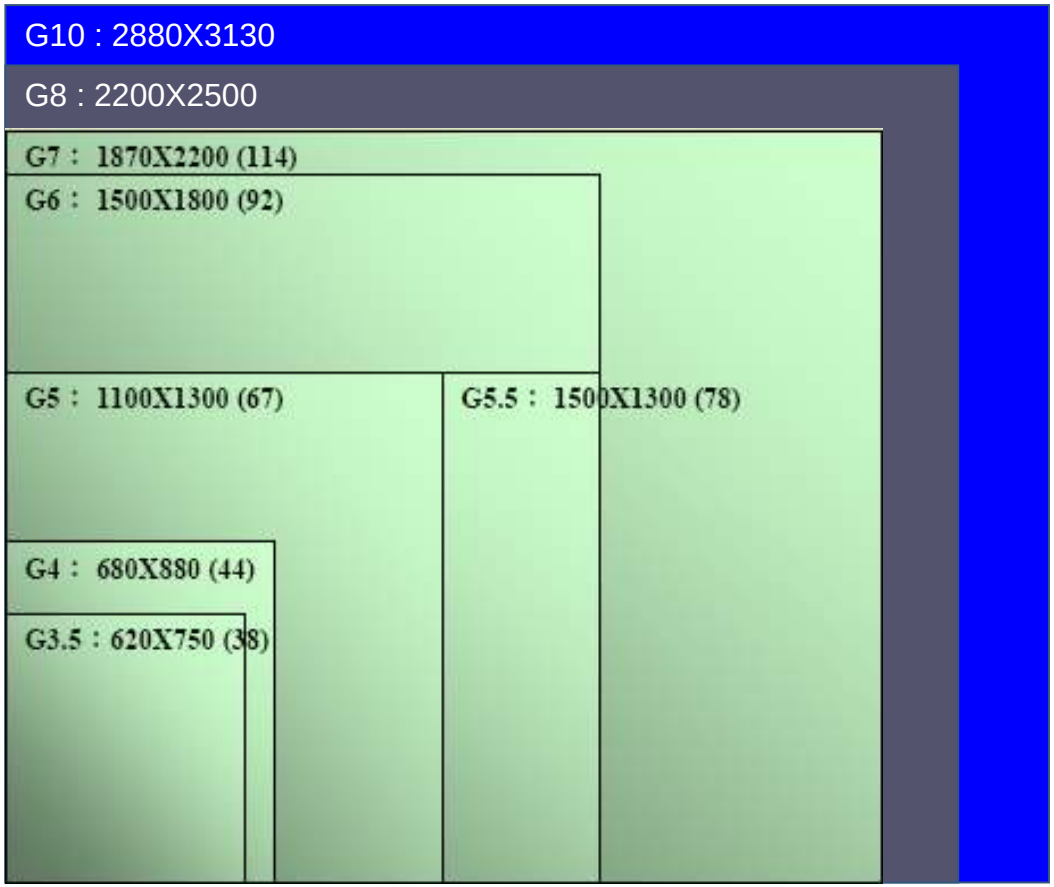
Production

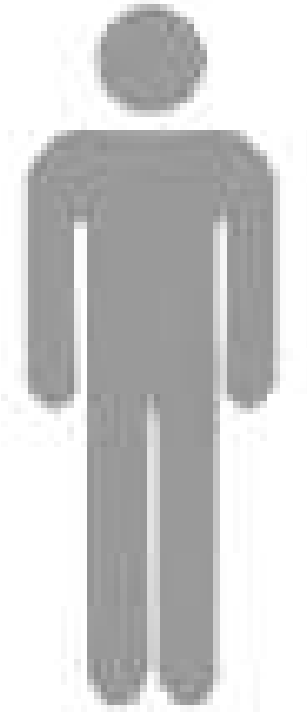
TFT-LCD產業概況

Generation

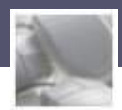


單位：mm



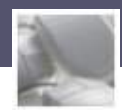
1800mm

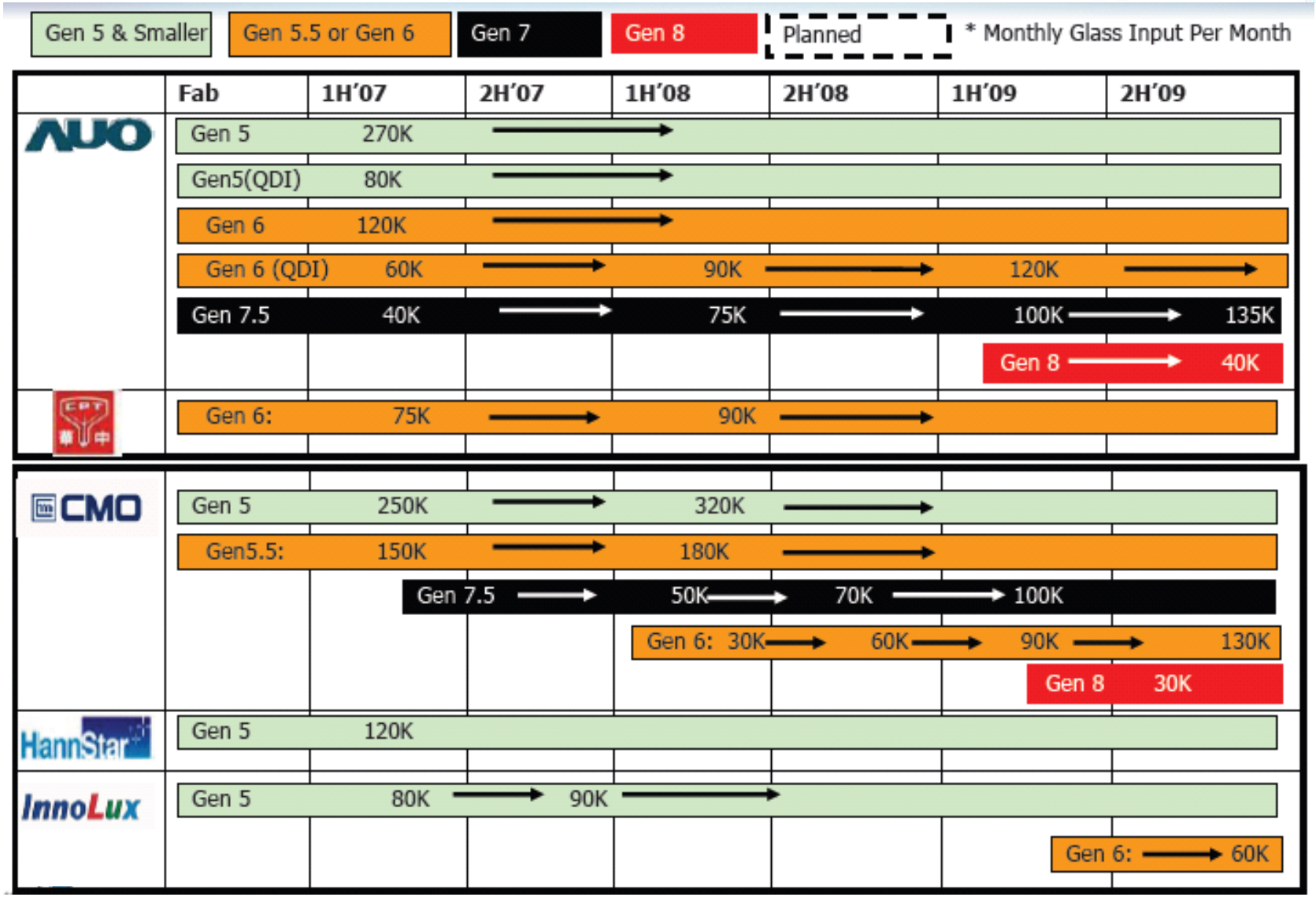
Glass To Panel

廠房	玻璃基板尺寸		26 吋	32 吋	37 吋	40 吋	42 吋	46 吋	47 吋
G 5	1100	1300	6	3	2	2	2	2	2
G 5.5	1300	1500	8	6	3	2	2	2	2
G 6	1500	1850	12	8	6	4	3	3	2
G 7	1870	2200	18	12	8	8	6	6	4
G 7.5	1950	2250	18	12	8	8	8	6	6

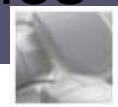
Taiwan TFT-LCD Capacity Expansion



Source: Displaysearch

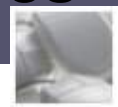
Taiwan TFT LCD Maker Capacity Strategies

		2006	2007/2008
AUO	L3C/D G3.5	14" NB	13.3"W, Revamp to LTPS for S/M
	L5A/L5B G5	15", 15.4",17W NB 15~22W MNT . 20,26TV	15.4W, 17W NB 15~24"W MNT, 26" TV
	L5C/L5D G5	14"W, 15.4",17W NB 15~22W MNT . 20,26TV	14"W, 15.4",17W NB 15~22W MNT . 20,26TV
	L6A G6	17,20W MNT , 26", 32" TV	15"W, 18.4"W,17", 20W MNT 32", 37" TV
	L6B G6	17,20W MNT , 26", 32" TV	20"W, 22"W, 32"TV
	AUO G7	42" TV	24"W MNT 32", 40", 42", 46" TV
CPT 華中	L1A, L1B G4.5	15.4" NB, 17" MNT	One Fab for S/M 15.4" NB, 17" MNT
	L2 G6	17", 20"W MNT, 32", 37" TV	17", 18.4"W 20W, 22W , 26W MNT,32", 37" TV

Source: Displaysearch

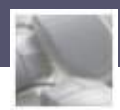
Taiwan TFT LCD Maker Capacity Strategies

			2006	2007/2008
CMO	Fab-3	G5	19"W MNT, 27"TV, 42", 47" →	NB, 19"W Monitor, 26" MNT/TV
	Fab-4	G5.5	22"W MNT, 27"TV, 32", 37" →	22"W Monitor, 26"TV, 32", 52"
	Fab-5	G5	19"W MNT, 42", 47" TV →	14W, 15.4W NB, 15.6W, 19"W Monitor, 26" TV, 42", 47" TV
	Fab-6	G6		25", 32", 37" (planning)
	Fab-7	G7		32",40",42", 46" 47" TV
HannStar		G5	19", 19"W →	17"W, 19", 22"W, 25"W,28"W
InnoLux		G5	15", 17", 19", 19"W MNT →	17", 19", 19"W, 22W MNT

Source: Displaysearch

Global TFT LCD Development Trend

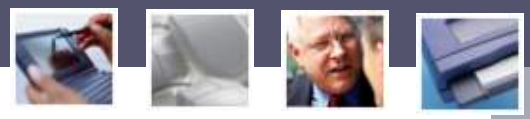



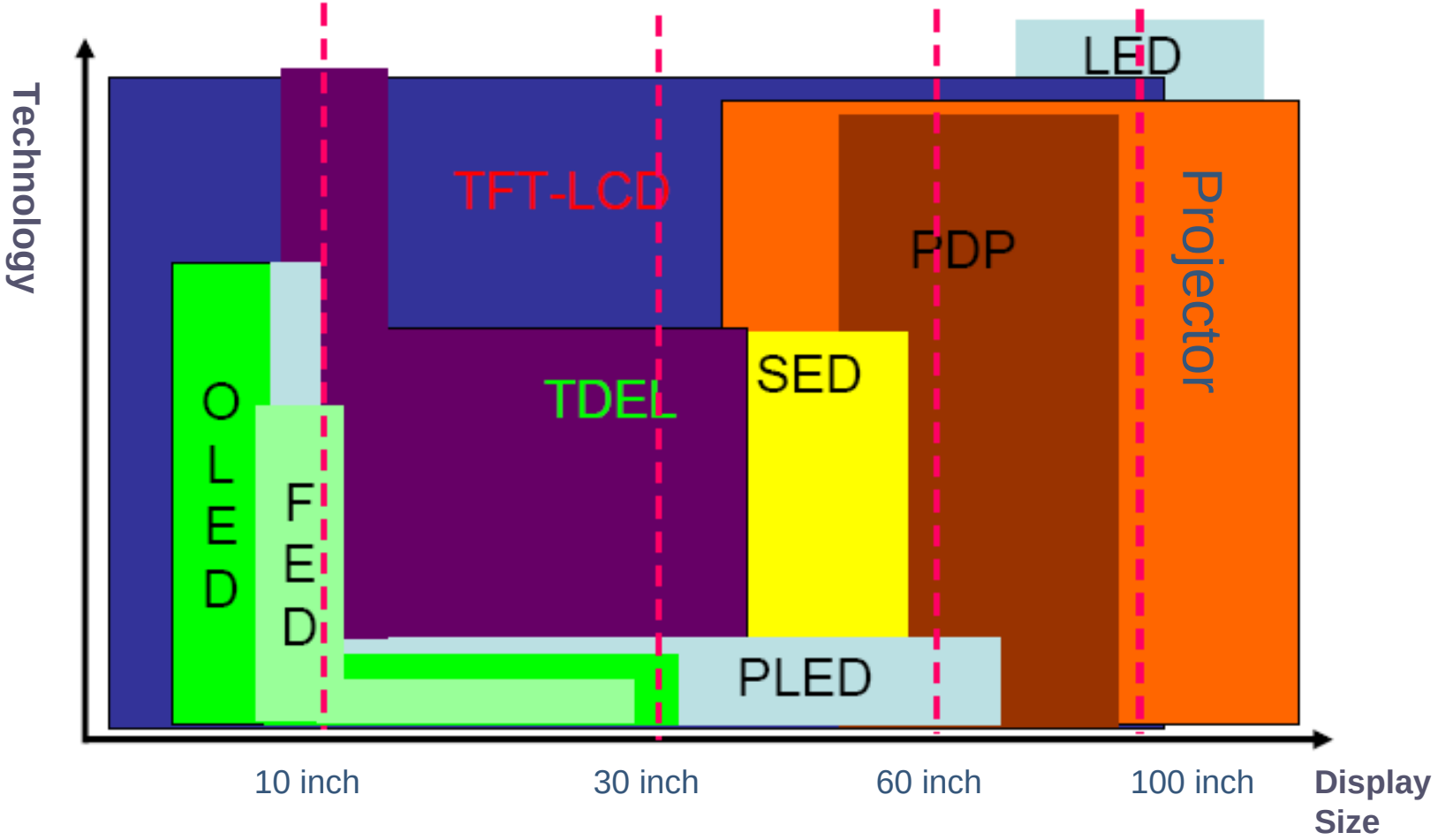
- Taiwanese & Korea panel makers will increase their share in the a-TFT LCD & Cell Panel market.
- Japanese makers has a advantage in the LTPS-TFT market .
- China panel maker can break into S/M TFT LCD market through cell panel business.

	S/M a- TFT LCD		LTPS-TFT		Cell Panel	
China	-	Great opportunity	-	Not Yet	-	Not Yet
Japan	↘	The share continuing down	↗	Global Leading position	↘	Facing strong competitors
Korea	↑	Fast growing	→	Flat	→	No3 in cell business
Taiwan	↑	Fast growing	↗	Fast growing	↗	Global Leadership position

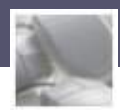
Source: Displaysearch

Display Size Map





TFT-LCD Development Trend

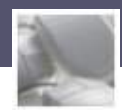
Panel SPEC Improved

- Color saturation NTSC 92% will be mainstream in spite of CCFL.
- Double frame rate 100/120Hz is used for high-end to work with ME/MC enhancement.
- DCR (dynamic contrast ratio) is more popular to reach more than 5000:1 (SCR 2000-3500:1).
- Scanning backlight is able to improve motion blur.
- Size: FHD will start from 32”. 52”and 65”will challenge PDP.

Panel Cost-Down

- FMB (front-mount bezel) can save a bracket cost and make bezel narrower. For some small sized design, even screw can be save with a mechanical fixing panel’s way (hook).
- IPB (integrated power board) is a kind of solution to eliminate invertors then cost down but still with balance board. The point is balance board cost and IPB power part to match.
- RSDS with T-con on main board’s reference architecture will be proposed in 2008.

TFT-LCD Development Trend

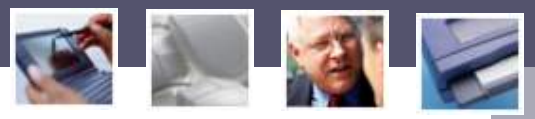
LCD TV Cost Reduction

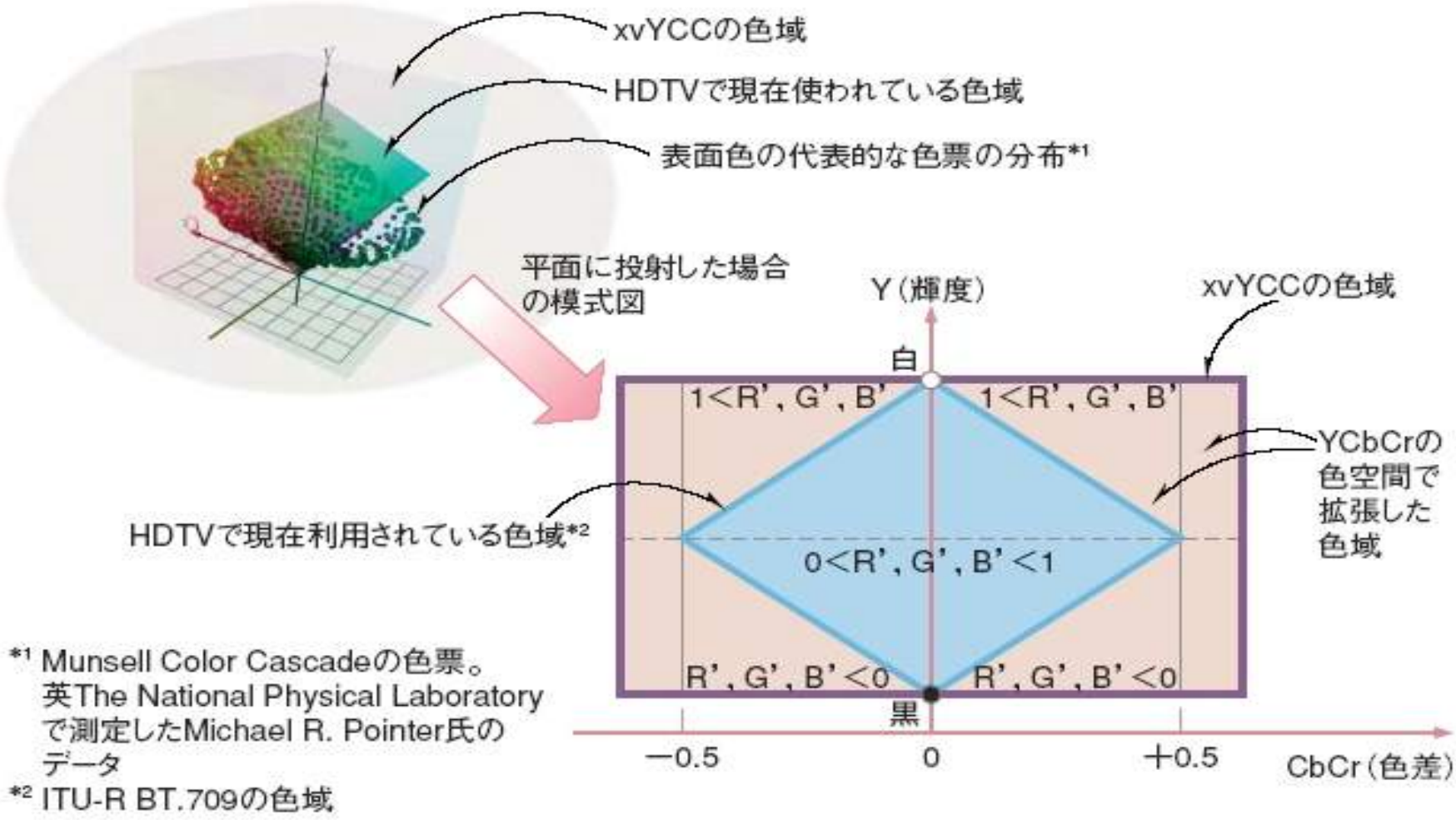
- Panel Cost Down
- B/L Cost Down (Film and CCFL)
- Polarizer Cost Down

New LED Backlight

- LED backlight (white and RGB) is better for slim design. Samsung uses side lighting type and white LED to make 40”LCM released at Oct’07 reaches 10mm in LCM and 5mm in B/L.
- LED side lighting can be designed thinner than direct lighting and CCFL. And it needs LGP (light guide plate) to make uniform. However, it can not support local dimming.
- Local dimming on LED direct lighting can save more power than CCFL.
- LED can reach NTSC 100% color saturation above.
- Color space is talked from sRGB (by Microsoft & HP 1996 for CRT and printer) to xvYCC (2006).

sRGB v.s xvYCC



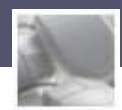


*1 Munsell Color Cascadeの色票。英The National Physical Laboratoryで測定したMichael R. Pointer氏のデータ

*2 ITU-R BT.709の色域

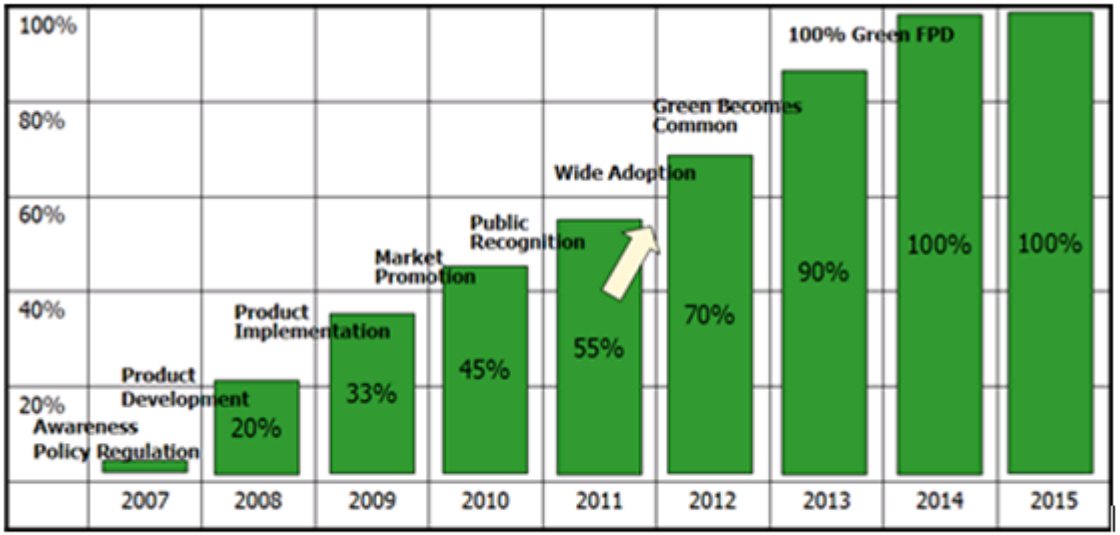
xvYCC所定義的色彩顯示（a wider color reproduction）是目前色域範圍約1.8倍，這樣的色彩表現已相當接近人類所能辨識的色彩。

TFT-LCD Development Trend-3

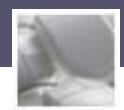
❖Green Display

- Green Panel Design
- Energy-Saving Production Processes
- Green Components
- Packaging Saving



Source: DisplaySearch *Green Technology in Flat Panel Displays: Market Technology and Trends Report*

TFT-LCD Development Trend-4

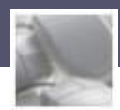



❖ 16:9

- Gen 6 and Gen 7 is designed for LCD TV (16:9). When Gen 5 will be occupied by notebook, panel makers need to find an appropriate MNT products in Gen6 and Gen 7.
- 16:9 advantage in panel maker point of view
  - Same cuts in the same fab, but size will be bigger than 16:10
  - Same size in the same fab, but cuts will be more than 16:10
- Next contents format (HD/Blue ray DVD, movie title, game) support 16:9 format. Content of 1080p decides the next "wide: definition

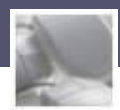
		Economic Cut														
Fab	Glass Size	15.6W	17W	18.5W	19W	20W	20W	21.6W	22W	23W	24W	24W	27W	27W	30W	31.5W
		16:9	16:10	16:9	16:10	16:9	16:10	16:9	16:10	16:9	16:10	16:9	16:9	16:10	16:10	16:9
G5	1100 x1250	18	12	10	8	8	8	8	6	8	6	6	6	4	2	2
G5	1100 x 1300	18	12	12	12	8	8	8	8	8	6	6	6	4	3	3
G5.5	1300 x 1500	24	15	18	15	12	12	12	12	8	8	8	8	6	6	6
G6	1500 x 1850	36	24	24	20	21	20	18	15	12	12	12	12	9	8	8
G7	1870 x 2200	54	36	36	35	32	28	24	24	24	20	18	18	15	12	12
G7.5	1950 x 2250	55	40	36	35	32	30	24	24	24	20	24	18	15	12	12

Source: Displaysearch

職場準備

Postgraduate or Work

神啊~~ 請指點我一條生路!!!

inotera memories

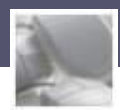
- 學歷 VS. 起薪 VS. 就業

迷思一：高學歷代表就業絕對可以更順利？

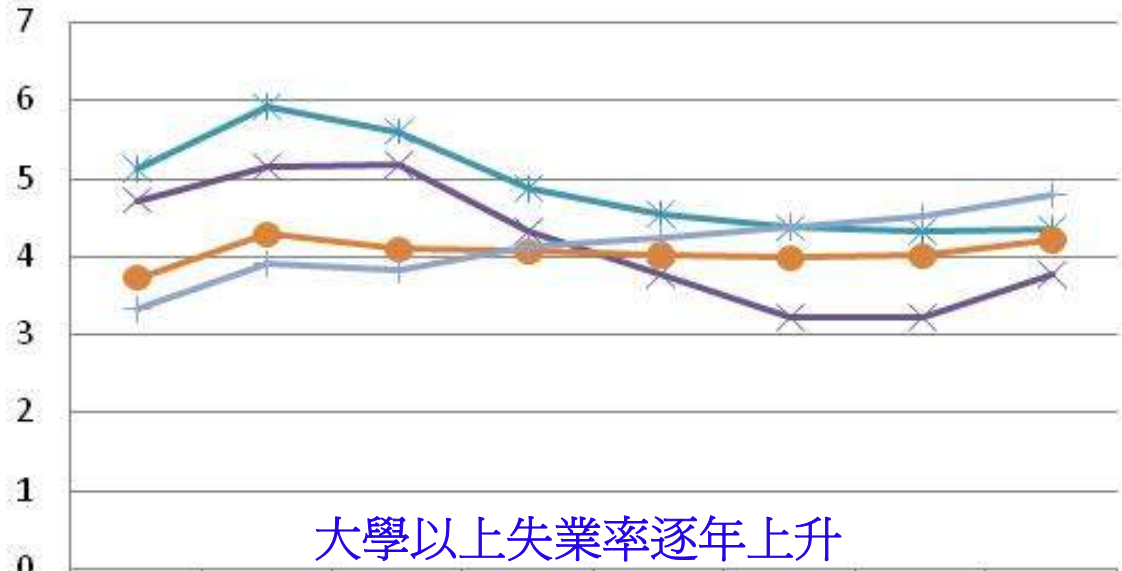
迷思二：念研究所一定可以提昇專業能力？

不要以念研究所來「逃避就業」！請先釐清你為何需要高學歷！

Unemployment

年度平均失業率--按教育程度區分(%)



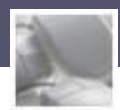
大學以上失業率逐年上升

	90年	91年	92年	93年	94年	95年	96年	97年
國中及以下	4.71	5.14	5.17	4.31	3.76	3.21	3.22	3.76
高中(職)	5.12	5.92	5.6	4.87	4.54	4.36	4.31	4.34
大專及以上	3.72	4.28	4.09	4.06	4.01	3.98	4	4.21
大專及以上 大學及以上	3.32	3.89	3.82	4.11	4.23	4.36	4.51	4.78

最高

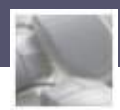
資料來源:行政院主計處

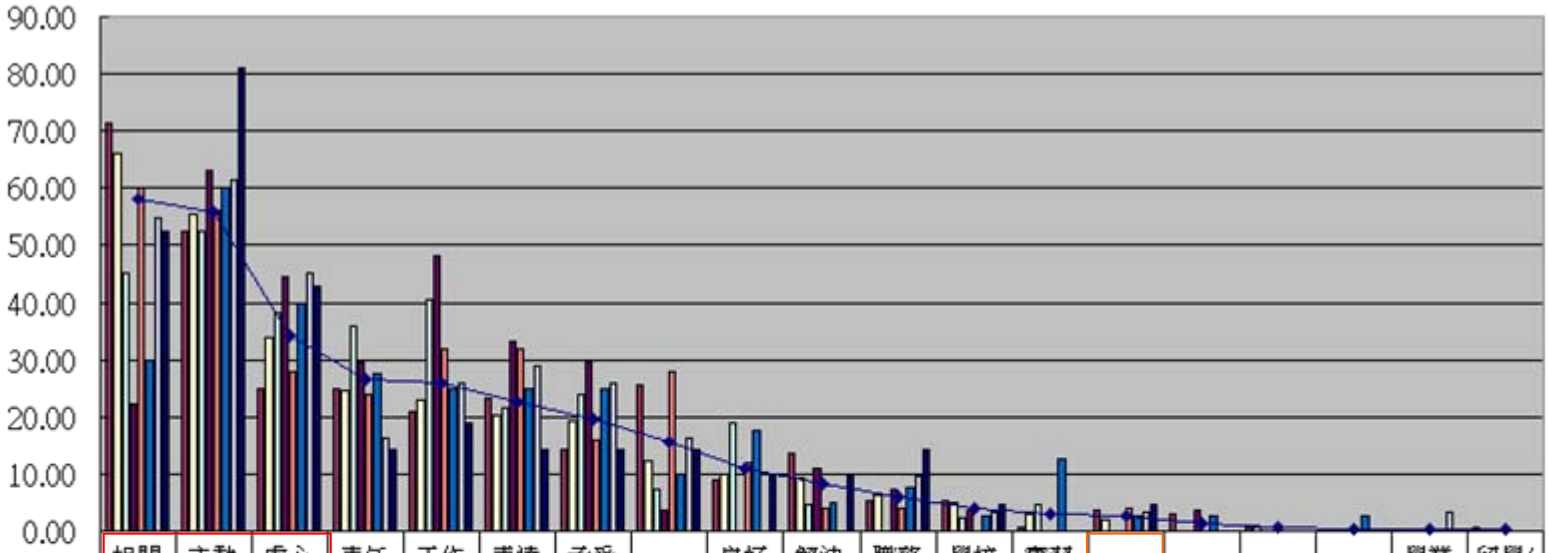
高學歷為何高失業

- 台灣產業轉型不順
- over-educated 「一種學歷，十種程度」
- 逃避就業的比例大增
- 高學歷後，不屑於屈就低階工作

不同產業篩選社會新鮮人的標準

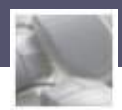





	相關科系畢業	主動積極態度	虛心學習精神	責任感足夠	工作熱忱度	表達溝通能力	承受壓力能力	專業能力	良好外語能力	解決問題能力	職務相關證照	學校知名度	實習打工經驗	碩士學歷	創意度	儀表出眾	社團經驗	學業成績優秀	留學/比賽經驗
電子資訊相關業	71.43	52.63	24.81	24.81	21.05	23.31	14.29	25.56	9.02	13.53	5.26	5.26	0.75	3.76	3.01	0.75	0.00	0.00	0.75
一般製造業	66.19	55.40	33.81	24.46	23.02	20.14	19.42	12.23	10.07	9.35	6.47	5.04	2.88	2.16	0.00	0.72	0.00	0.00	0.00
批發及零售業	45.24	52.38	38.10	35.71	40.48	21.43	23.81	7.14	19.05	4.76	0.00	2.38	4.76	0.00	0.00	0.00	0.00	0.00	0.00
金融投顧及保險業	22.22	62.96	44.44	29.63	48.15	33.33	29.63	3.70	0.00	11.11	7.41	3.70	0.00	0.00	3.70	0.00	0.00	0.00	0.00
文教相關業	60.00	56.00	28.00	24.00	32.00	32.00	16.00	28.00	12.00	4.00	4.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00
一般服務業	30.00	60.00	40.00	27.50	25.00	25.00	25.00	10.00	17.50	5.00	7.50	2.50	12.50	2.50	2.50	0.00	2.50	0.00	0.00
建築營造及不動產相關業	54.84	61.29	45.16	16.13	25.81	29.03	25.81	16.13	0.00	0.00	9.68	3.23	0.00	3.23	0.00	0.00	0.00	3.23	0.00
醫療保健及環境衛生業	52.38	80.95	42.86	14.29	19.05	14.29	14.29	14.29	9.52	9.52	14.29	4.76	0.00	4.76	0.00	0.00	0.00	0.00	0.00
Total	58.01	55.87	34.34	26.51	25.80	22.42	19.57	15.66	10.85	8.36	5.87	4.09	3.02	2.49	1.42	0.71	0.18	0.18	0.18

資料來源:104人力銀行

專業技能的迷思

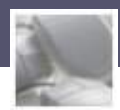



- 「就業力」不等於專業技能或學歷

- 職能冰山理論：職能＝K（Knowledge知識）＋A（Attitude態度）＋S（Skill技能），知識與技能只是表面看得到的競爭力，冰山下的特質(態度)才是影響績效表現的重點。

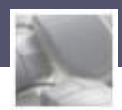
- 迷思：年輕人自認為最需要強化的是「專業技能」，然而企業認為要改善的是「工作態度」。

人力資源趨勢

- 學經歷/專業能力/跨領域能力
- 基礎能力：外語能力、資訊工具運用能力、溝通能力
- 軟性技能：創新思考能力、會議管理能力、企劃寫作能力
- 性格能力：IQ +EQ+AQ =3Q very much
- 性格 > 專業：找志同道合的人而不是找最優秀的人

Workplace Realization

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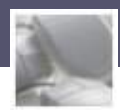
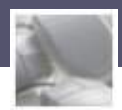
Attitude

態度決定一切，正向思考使未來更美好

Data Sources

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Q & A

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