

# LCD結構解析與實體拆解

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光電所 - 葉志傑

製造所 - 李朝修

光電所 - 吳紹銘

# LCD結構解析大綱

- TFT LCD 原理與結構篇
  - 動作原理
  - 實體解剖
- TFT & CF 功能與製程篇
  - Thin Film Transistor
  - Color Filter
- LCD 背光模組篇
  - 結構
  - 技術
- 結論

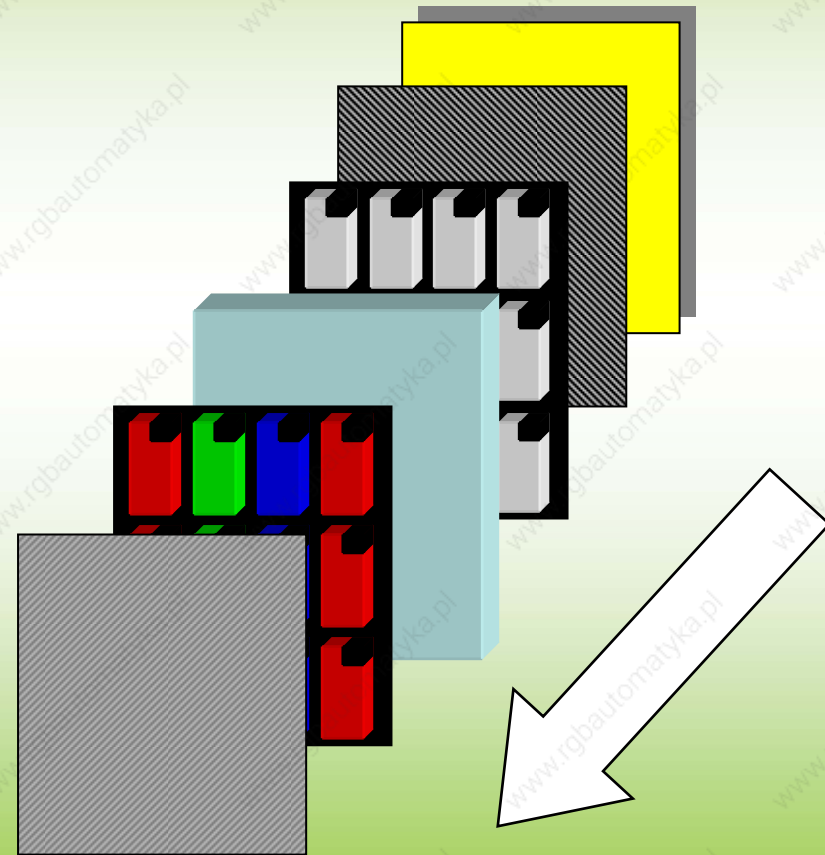
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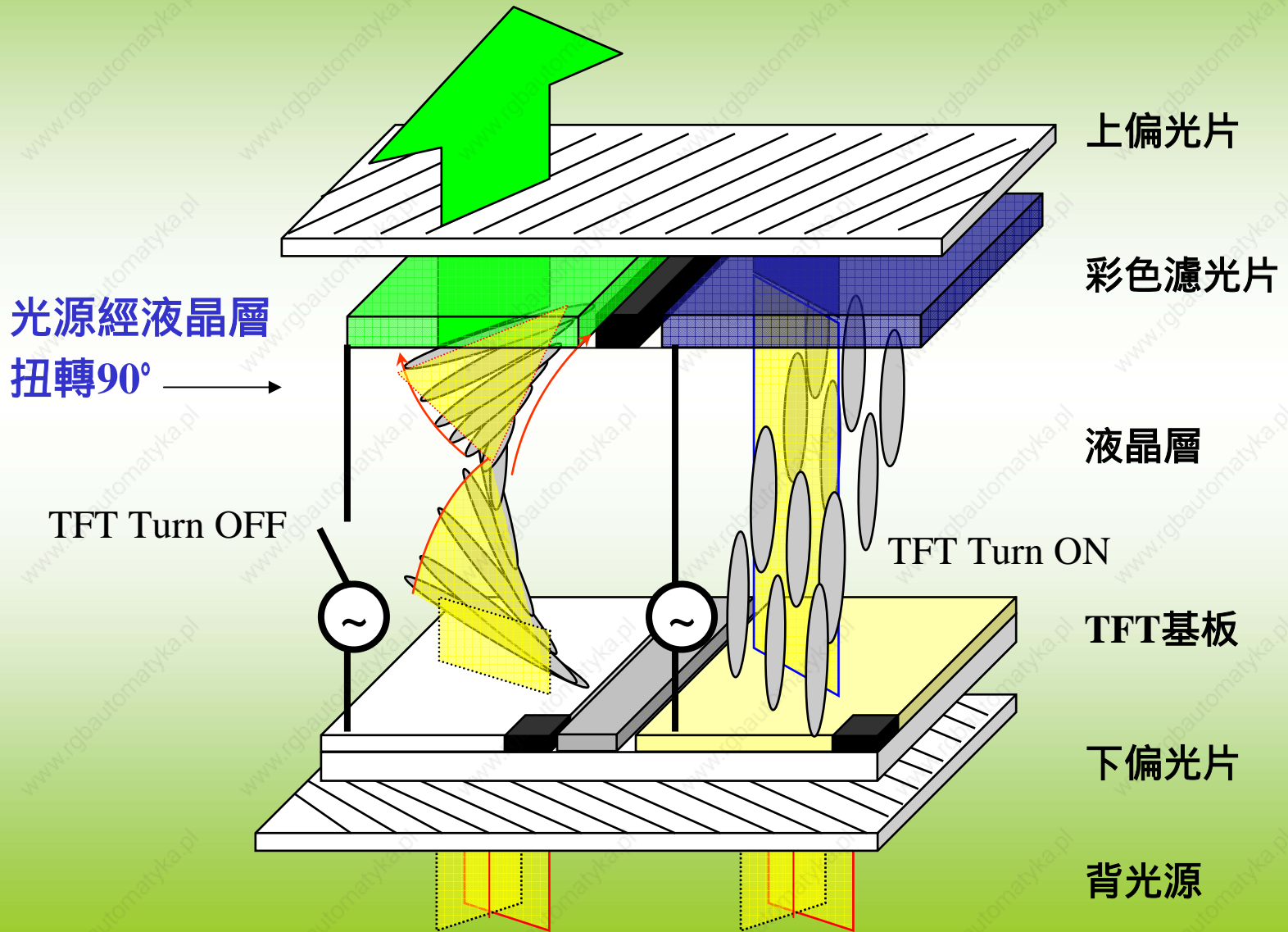
# TFT-LCD產品的基本構成元件

- **基本構造**

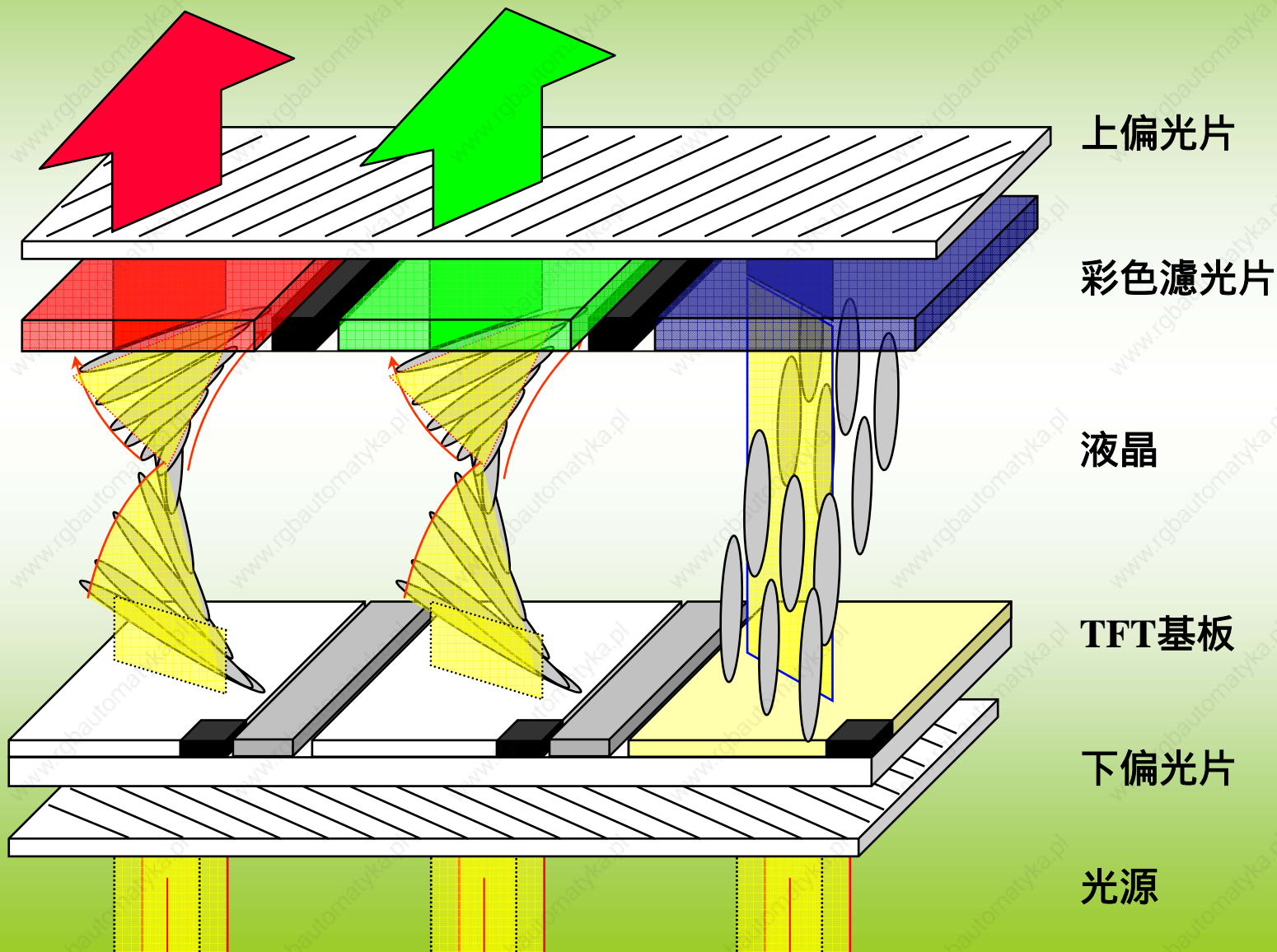
- 背光板(BACK LIGHT)
- 下偏光片(DOWN POLARIZER)
- 薄膜基板(TFT SUBSTRATE)
- 液晶(LIQUID CRYSTAL)
- 彩色濾光片(COLOR FILTER )
- 上偏光片(UP POLARIZER)



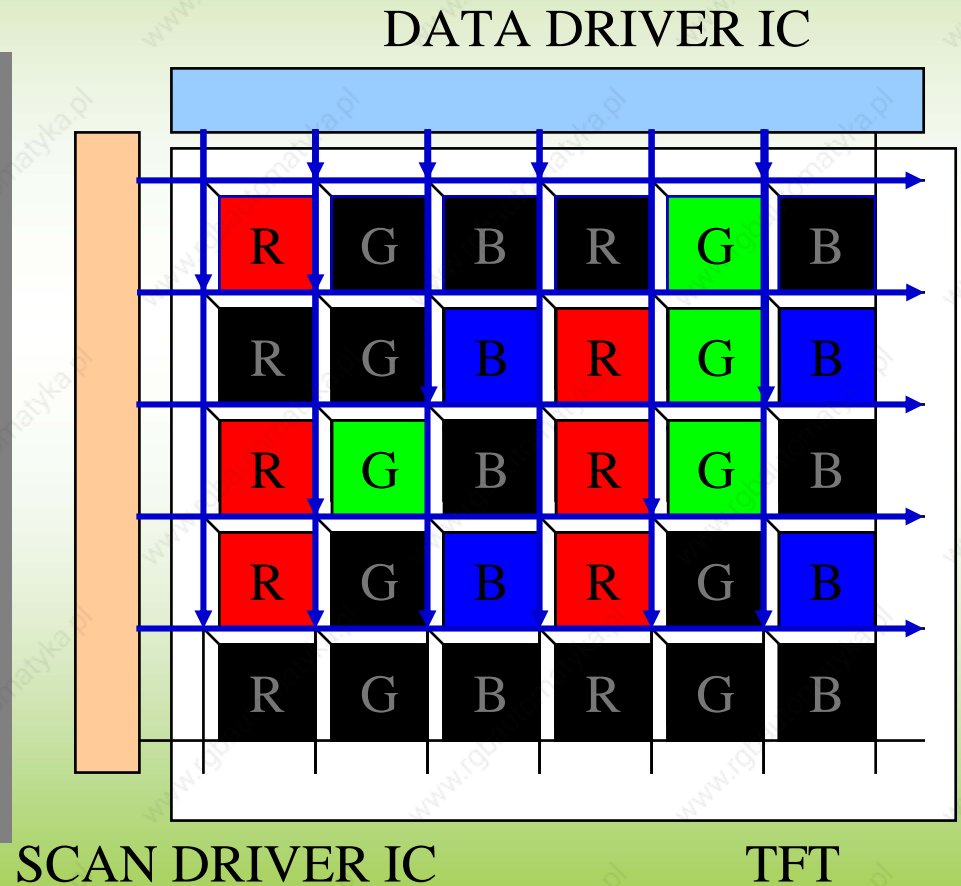
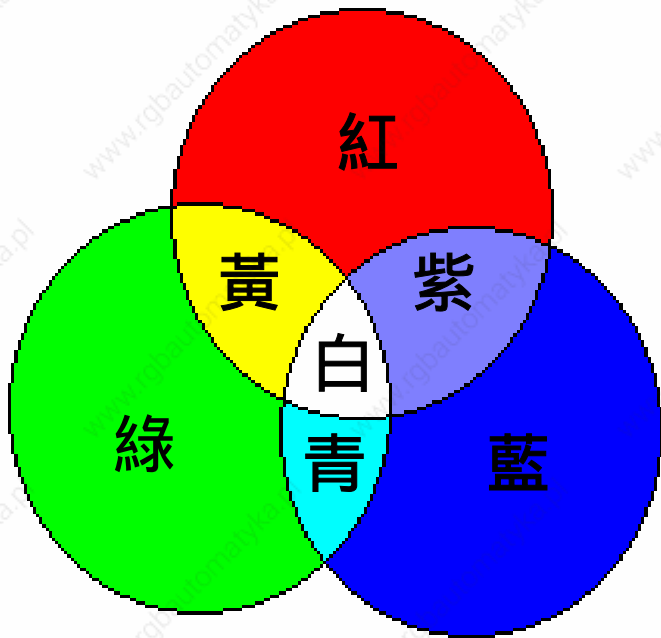
# TFT-LCD的顯示原理 (一)



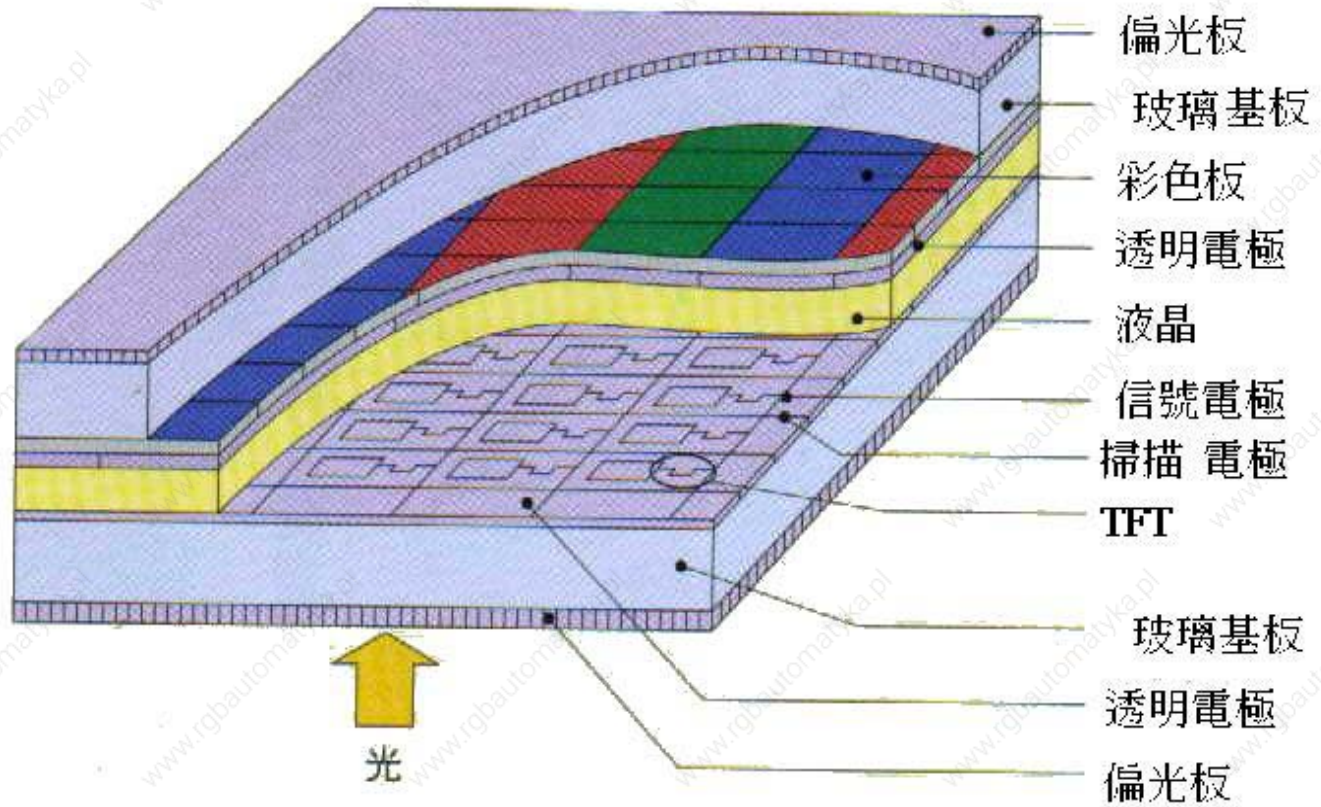
# TFT-LCD的顯示原理 (二)



# TFT-LCD 的驅動原理

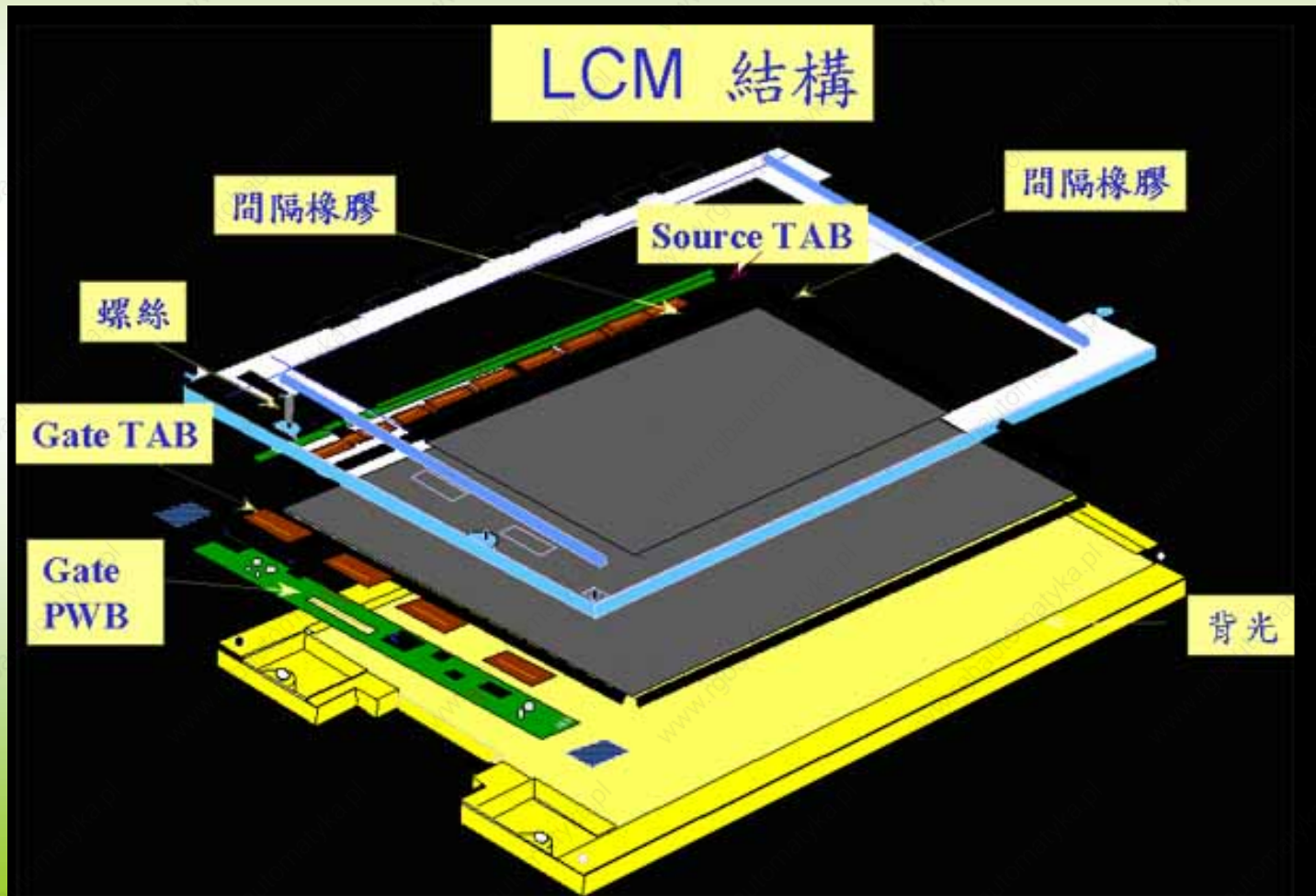


# 面板結構圖





# LCD面板機械結構



# 待分解LCD螢幕

- 螢幕



# 面板規格說明

- Vendor : SANYO (MXS121022010)
- Display type : 12.1" color TFT LCD
- Max. resolution : 800 x 600
- Max. colors : 262K
- Luminance (brightness) : 200 cd/m<sup>2</sup>
- Viewing angle : 90°(H), 40°(V)
- LCD MTBF : 50,000 hrs
- Backlight MTBF : 20,000 hrs
- Interface: VGA
- Operating temperature : 0 ~ 50°C

# LCD模組寫真

- 面板正面



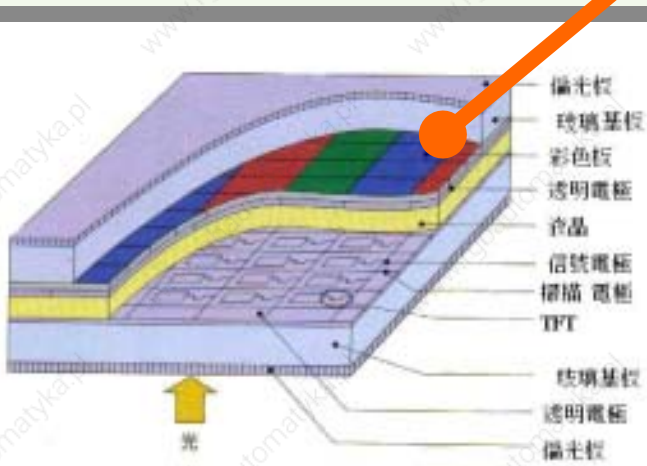
# LCD模組寫真

- 面板正面



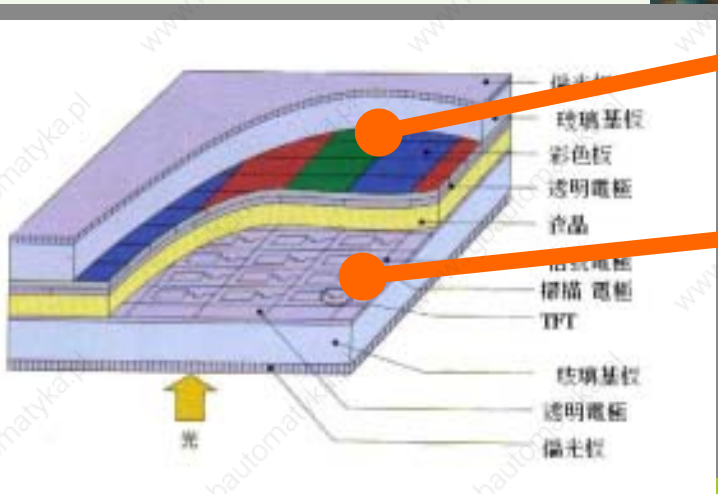
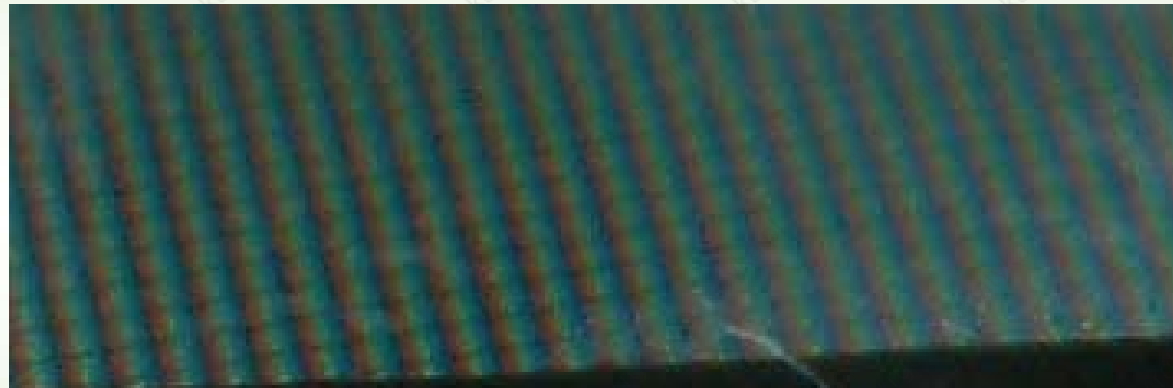
# LCD模組寫真

- 近看的面板表面

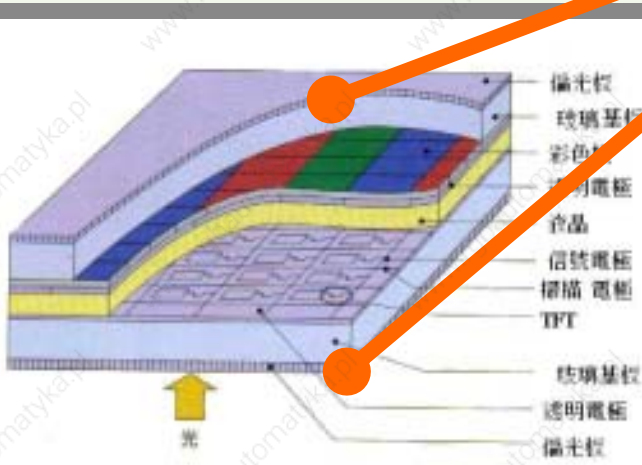
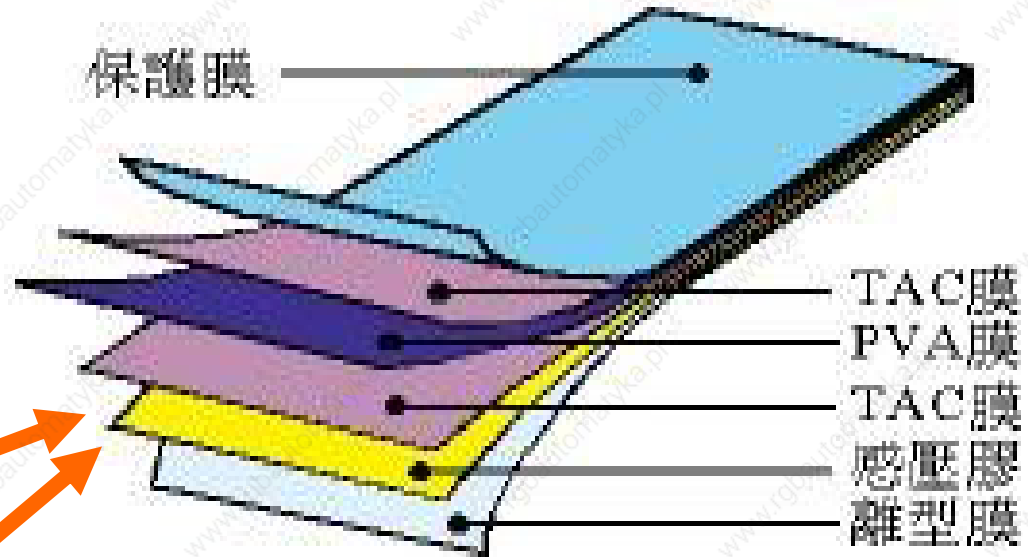


# LCD模組寫真

- 破壞後之面板

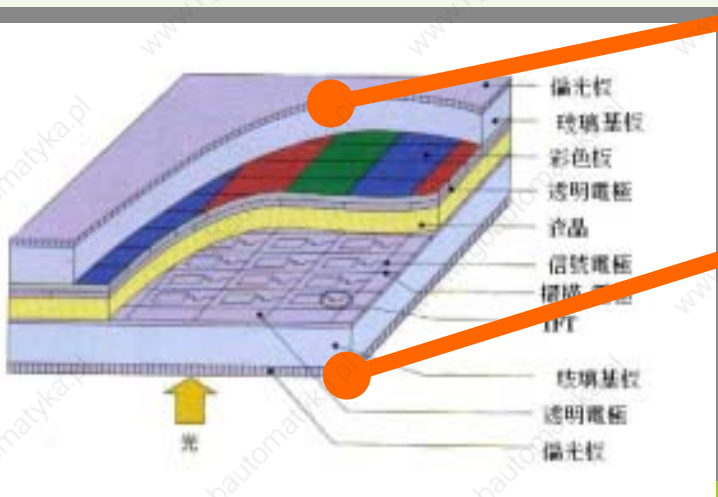
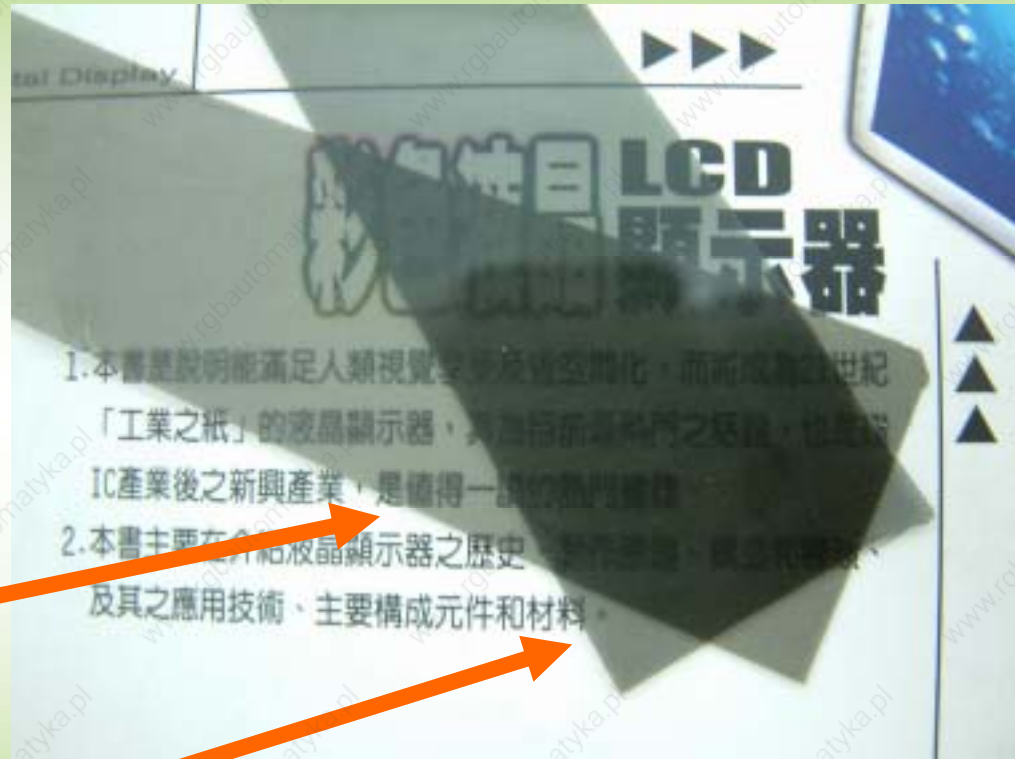


# 偏光板結構圖





# 偏光板寫真



# LCD模組動畫

- 偏光板

當上下兩片極化方向垂直時，  
光線無法穿透（如影片所示）

# VGA驅動電路模組

- 影像訊號電路



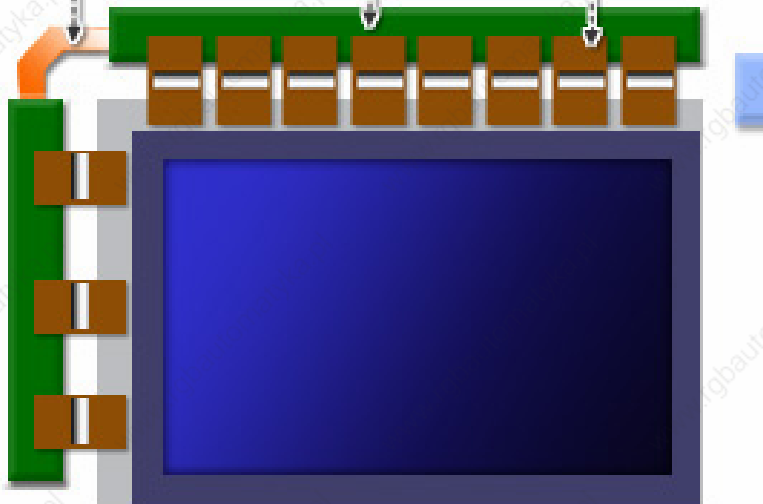
# TFT驅動電路

## Conventional Configuration

FPC

PCBA

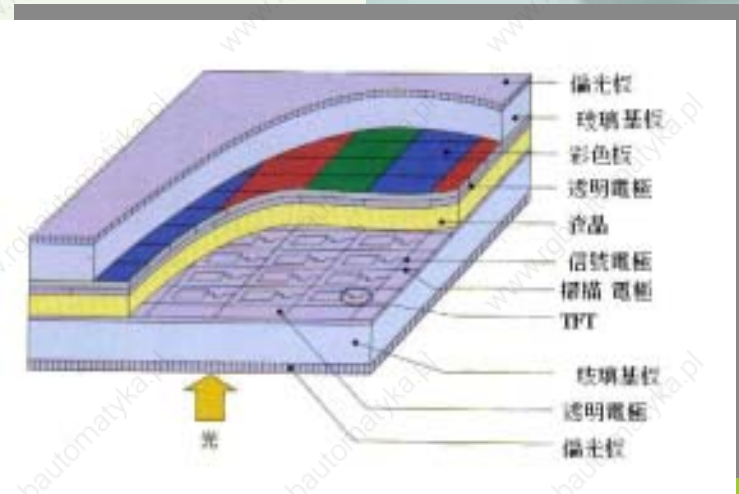
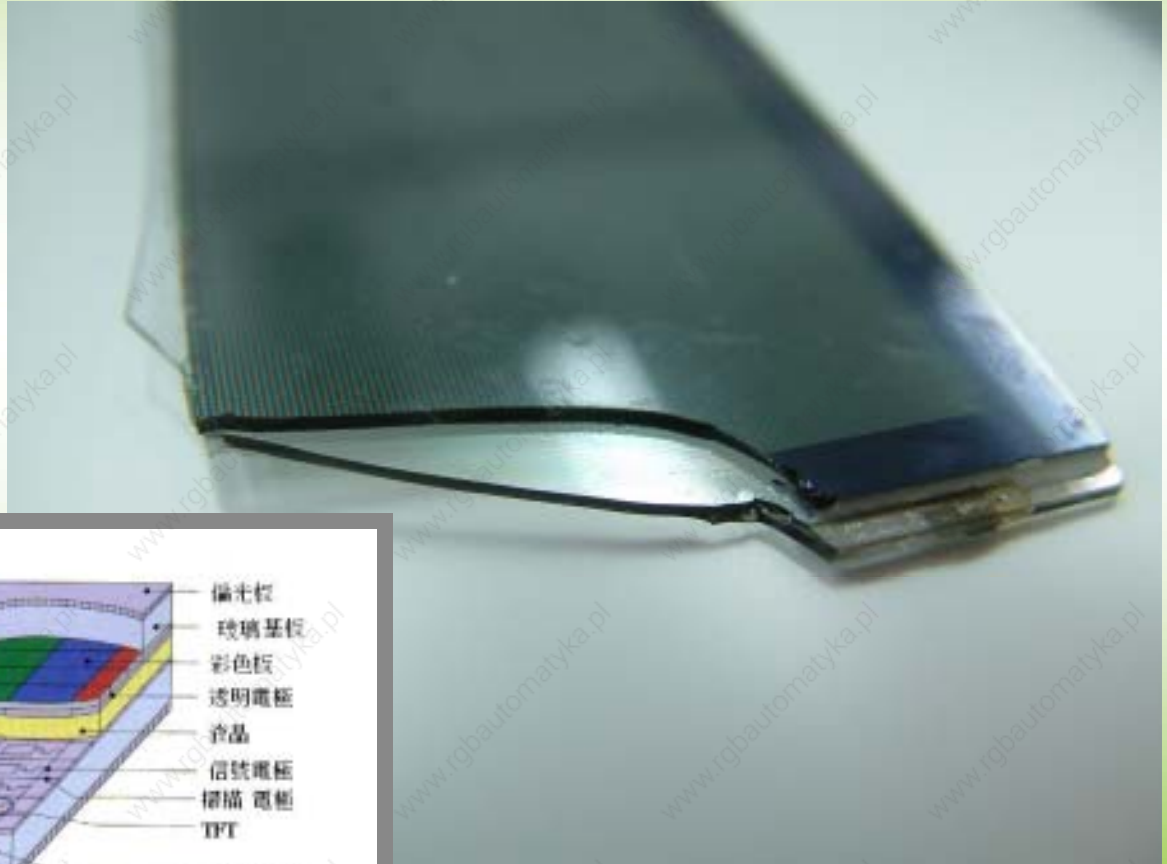
TAB



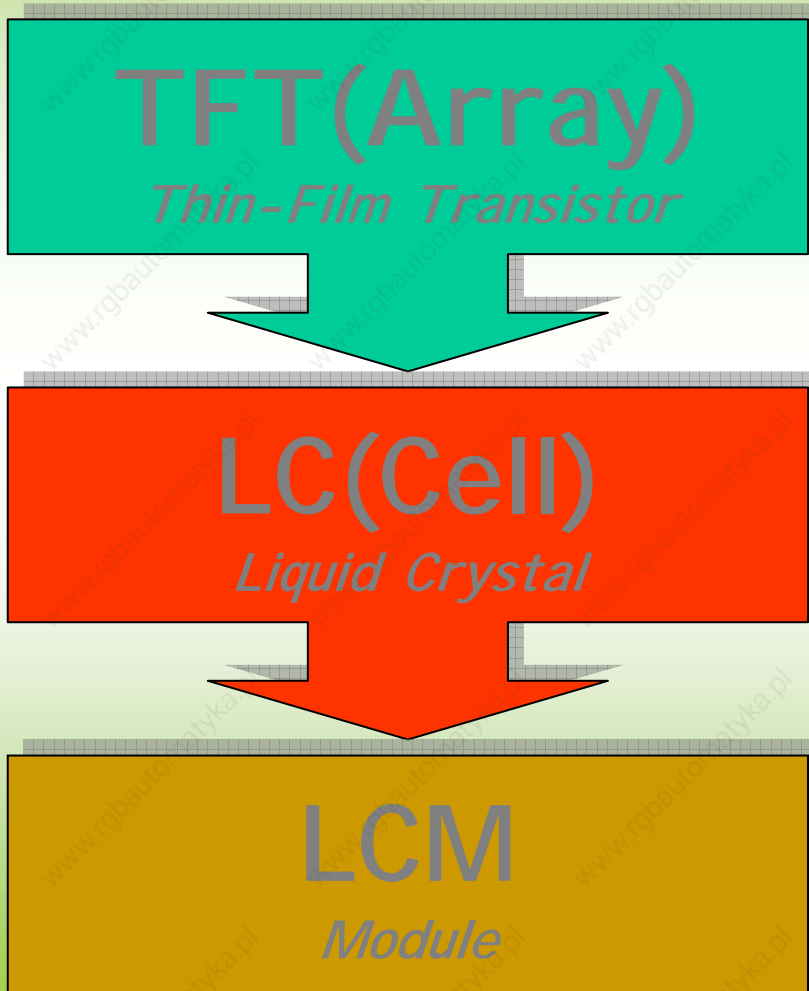
# LCD結構解析

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# LCD面板三明治寫真



# LCD製造流程概述



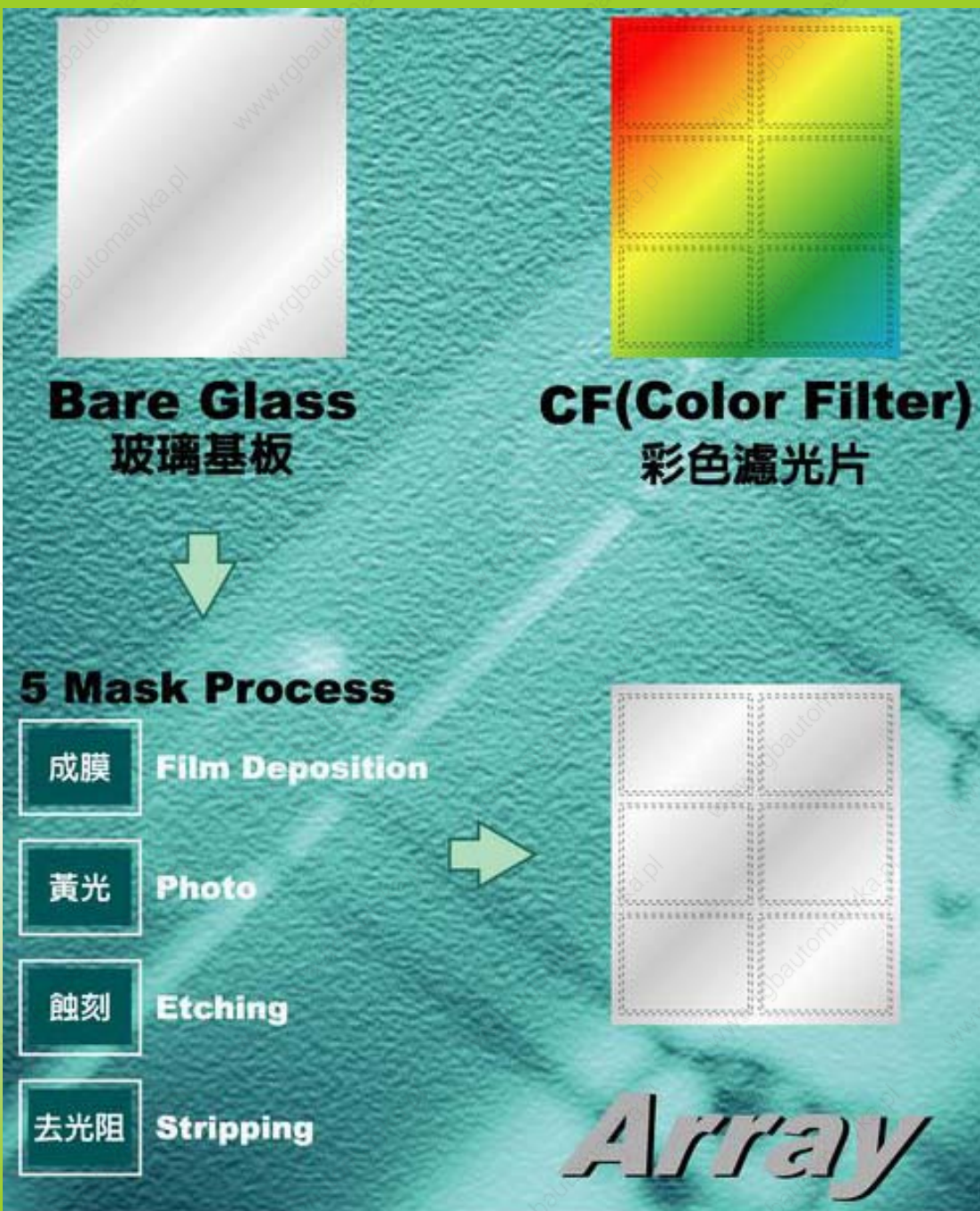
**Array:電晶體  
(矩形陣列)  
TFT基板生成**

**Cell:面板生成  
(Panel)**

**Module:產品模組  
組裝**

# 前段Array

製程與半導體製程相似，但不同的是將薄膜電晶體製作於玻璃上，而非矽晶圓上

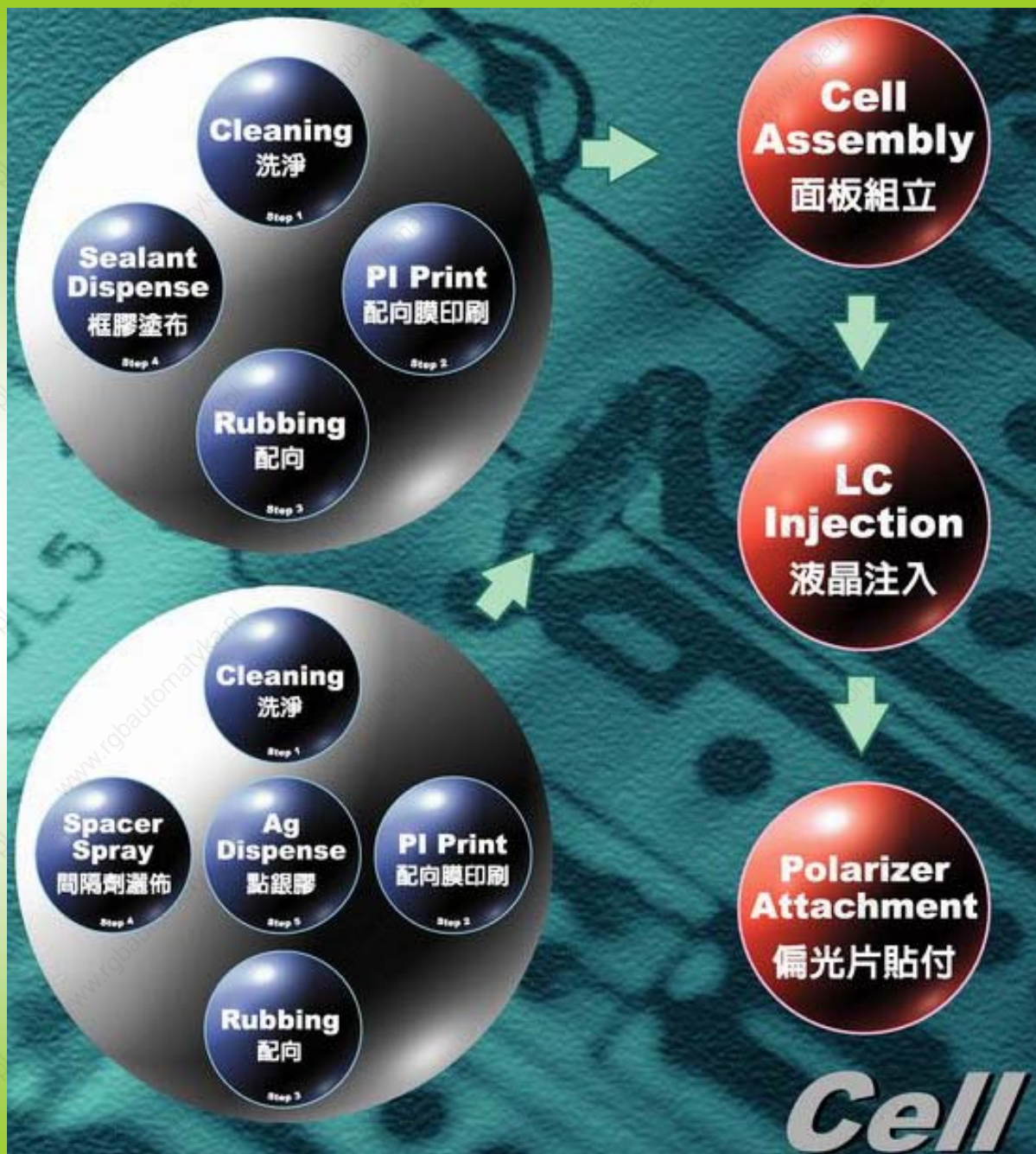




# 中段Cell

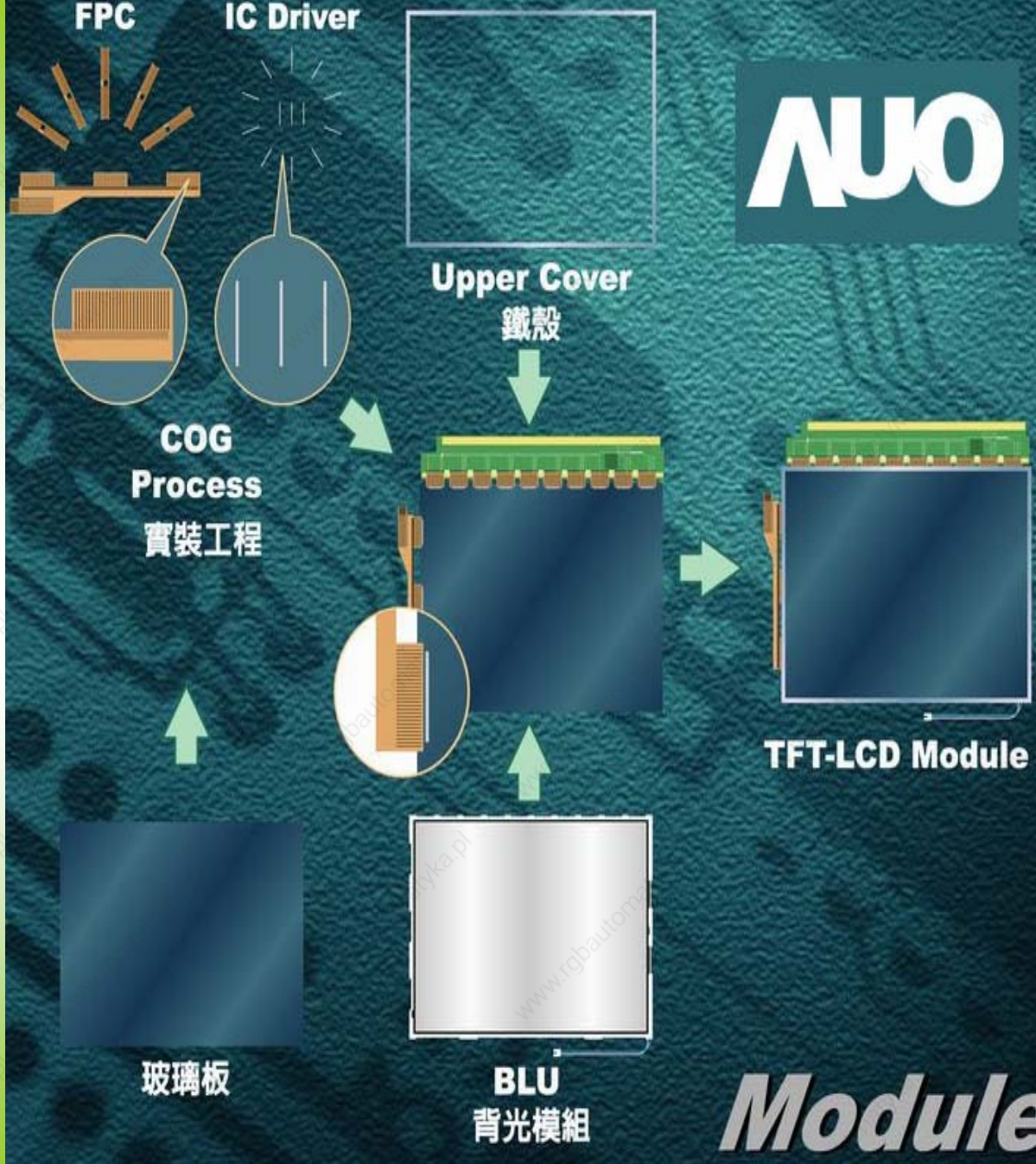
以前段

Array的玻璃為基板，與彩色濾光片的玻璃基板結合，並在兩片玻璃基板間灌入液晶(LC)。

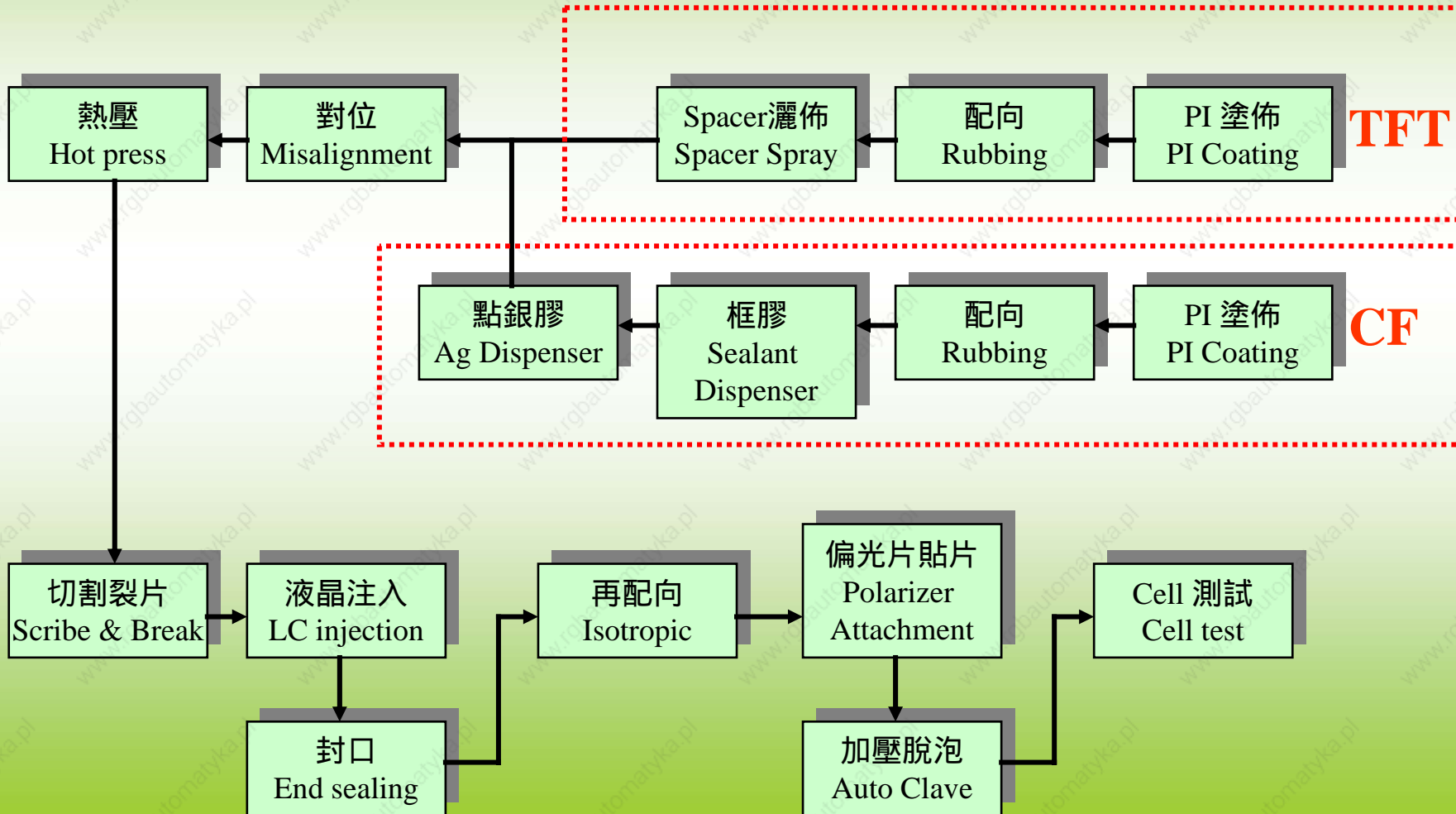


# 後段 Module Assembly

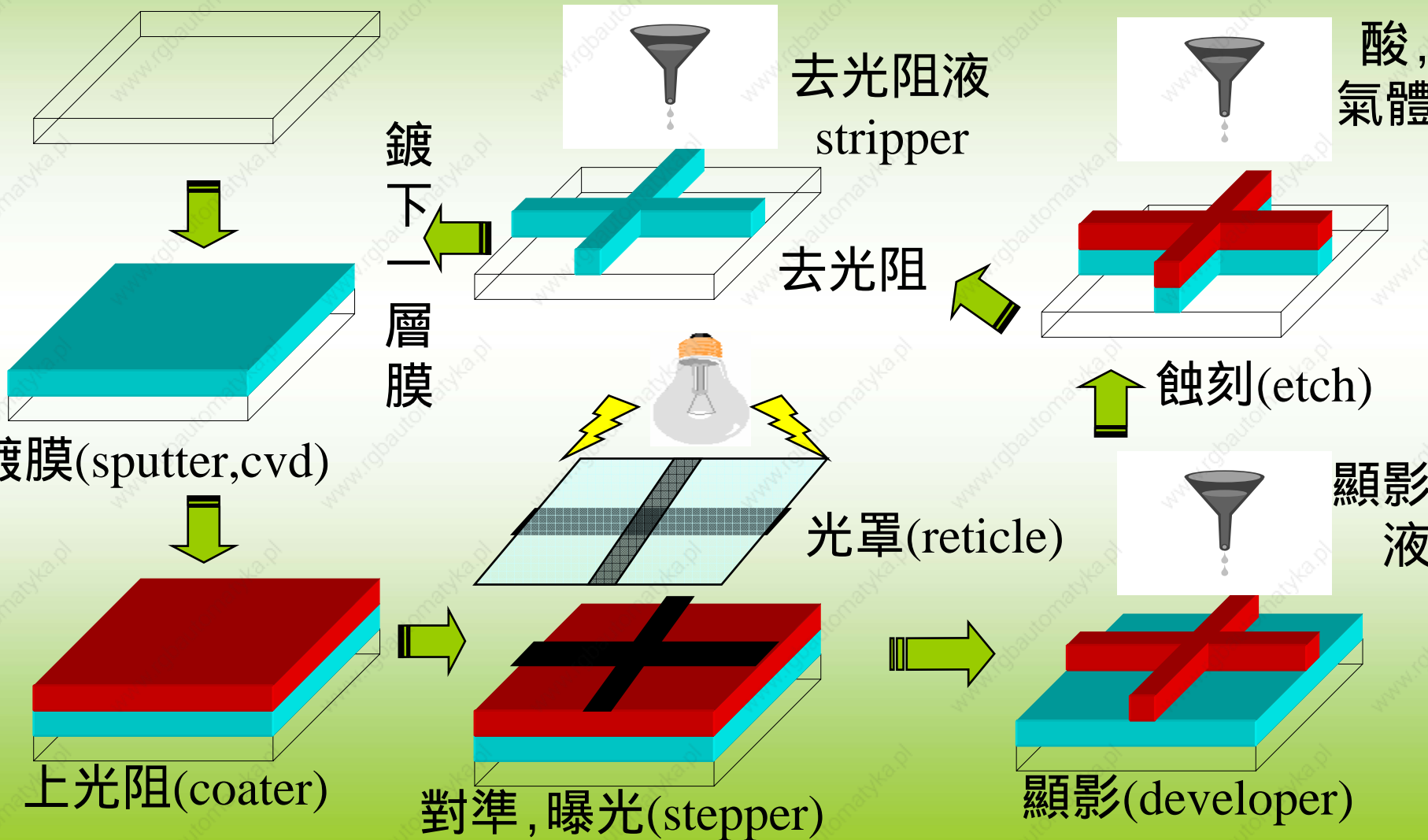
後段模組組裝製程是將Cell製程後的玻璃與其他如背光板、電路、外框等多種零組件組裝的生產作業



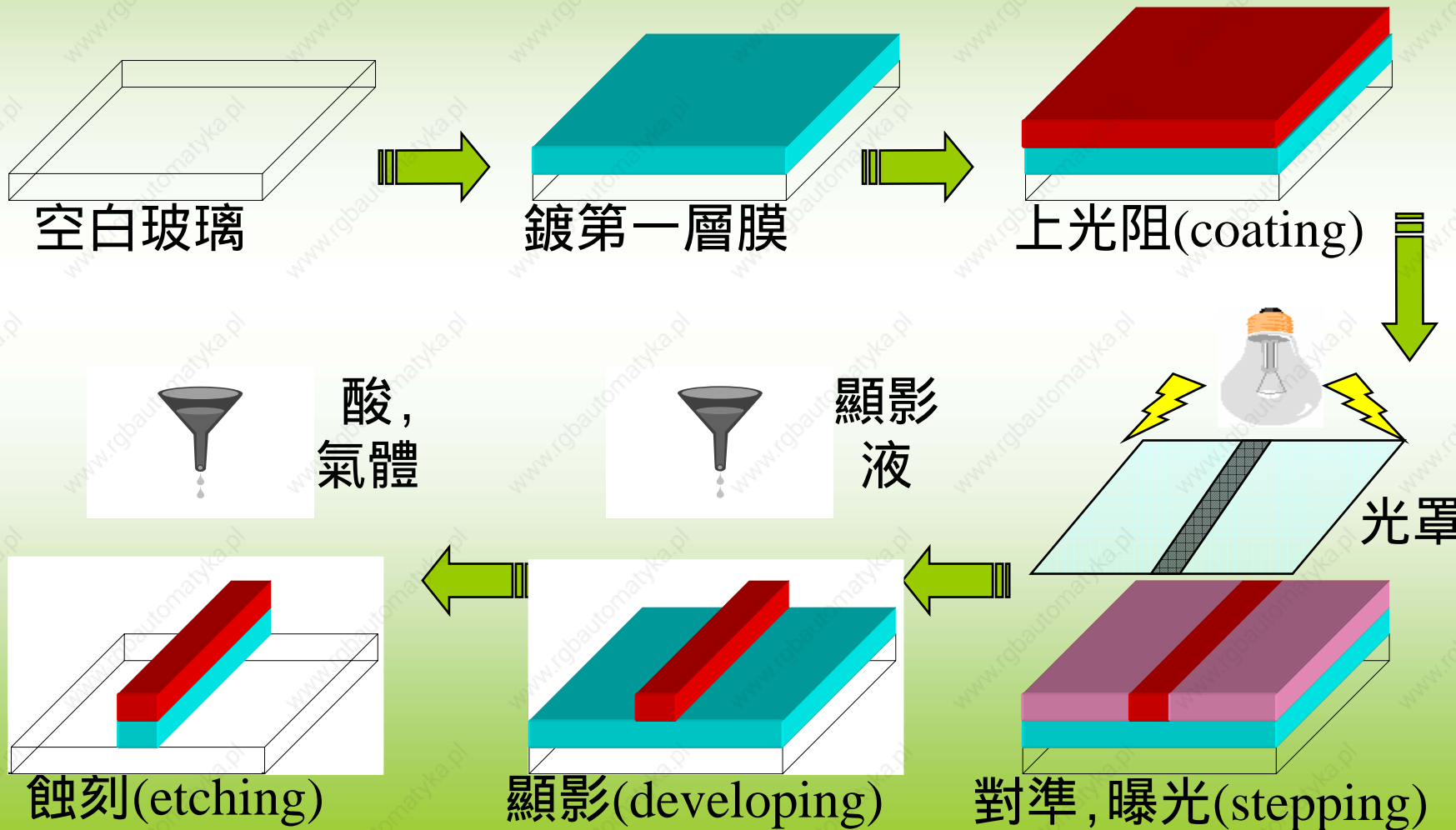
# 製造流程概述



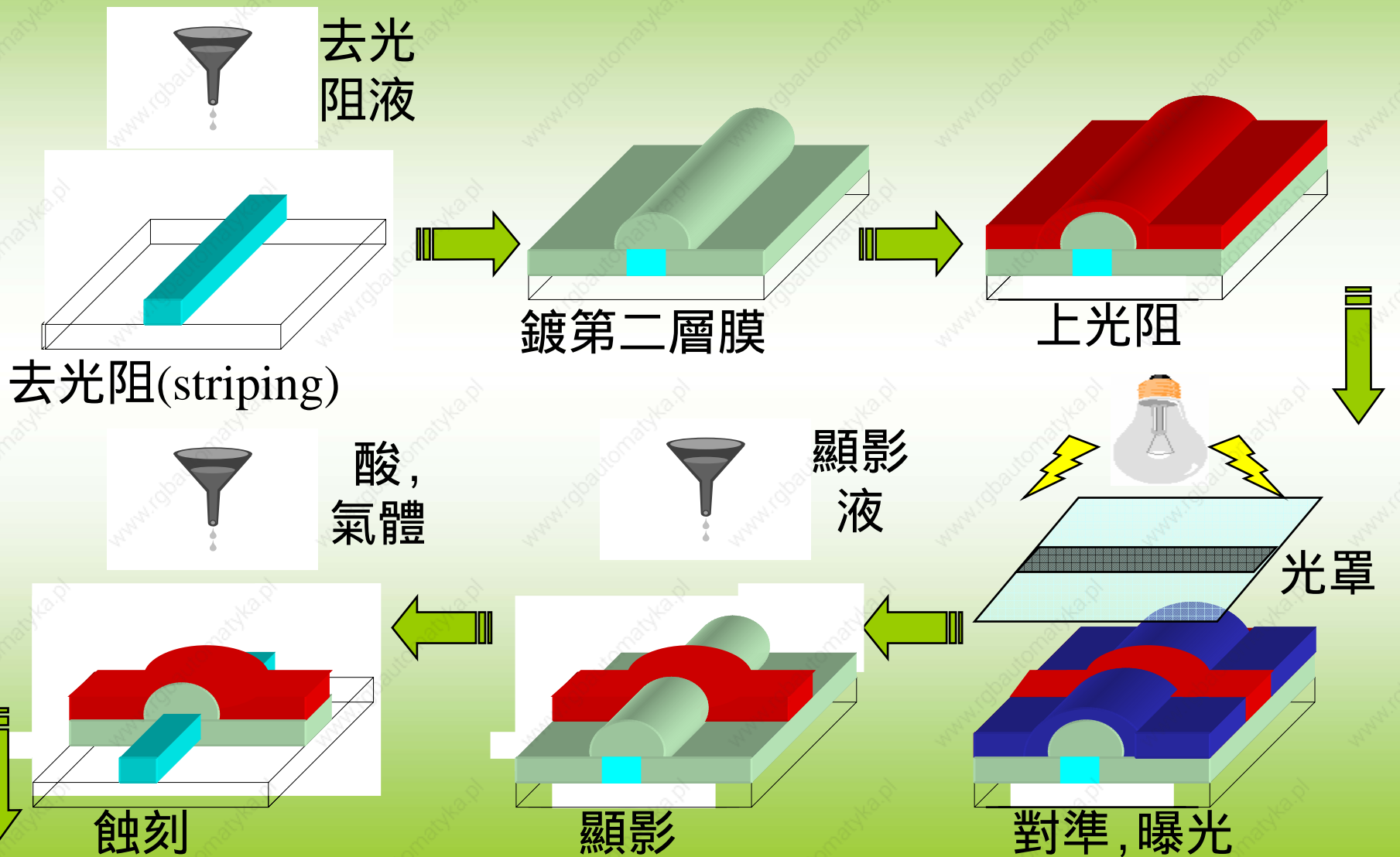
# TFT的製造流程概述



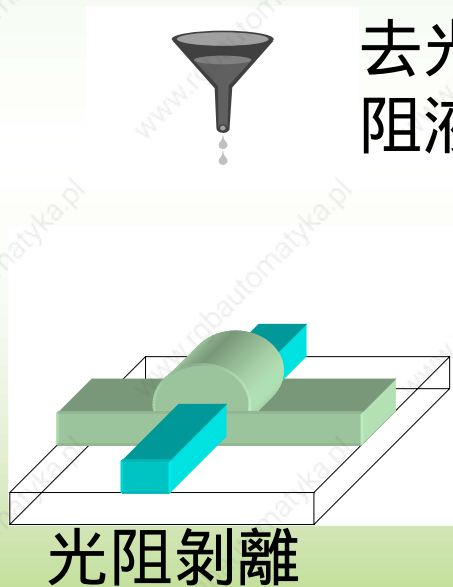
# TFT的循環製程圖解 1/3



# TFT的循環製程圖解 2/3



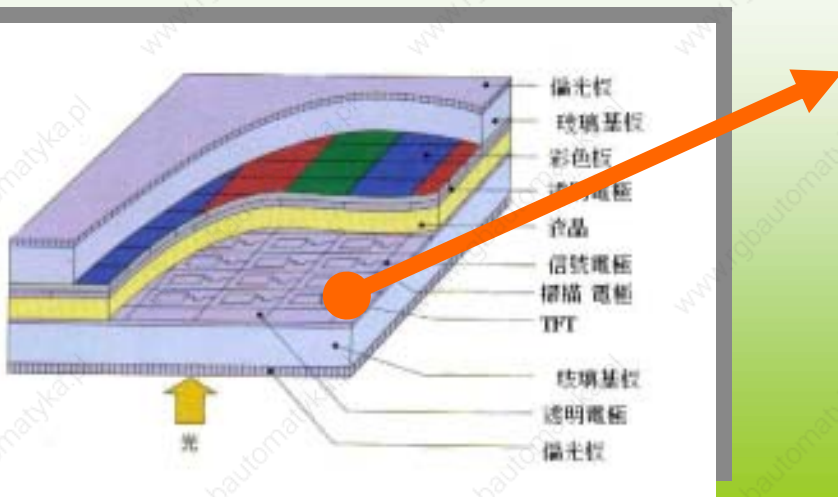
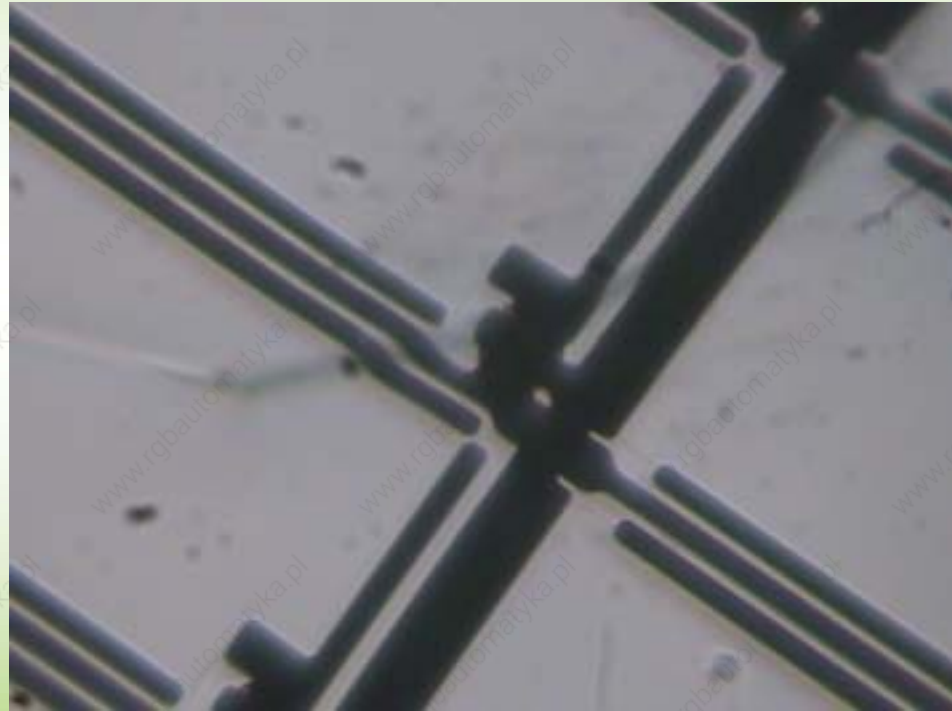
# TFT的循環製程圖解 3/3



**鍍第三層膜**，  
請依之前所  
示範的方法  
舉一反三，自  
行模擬想像

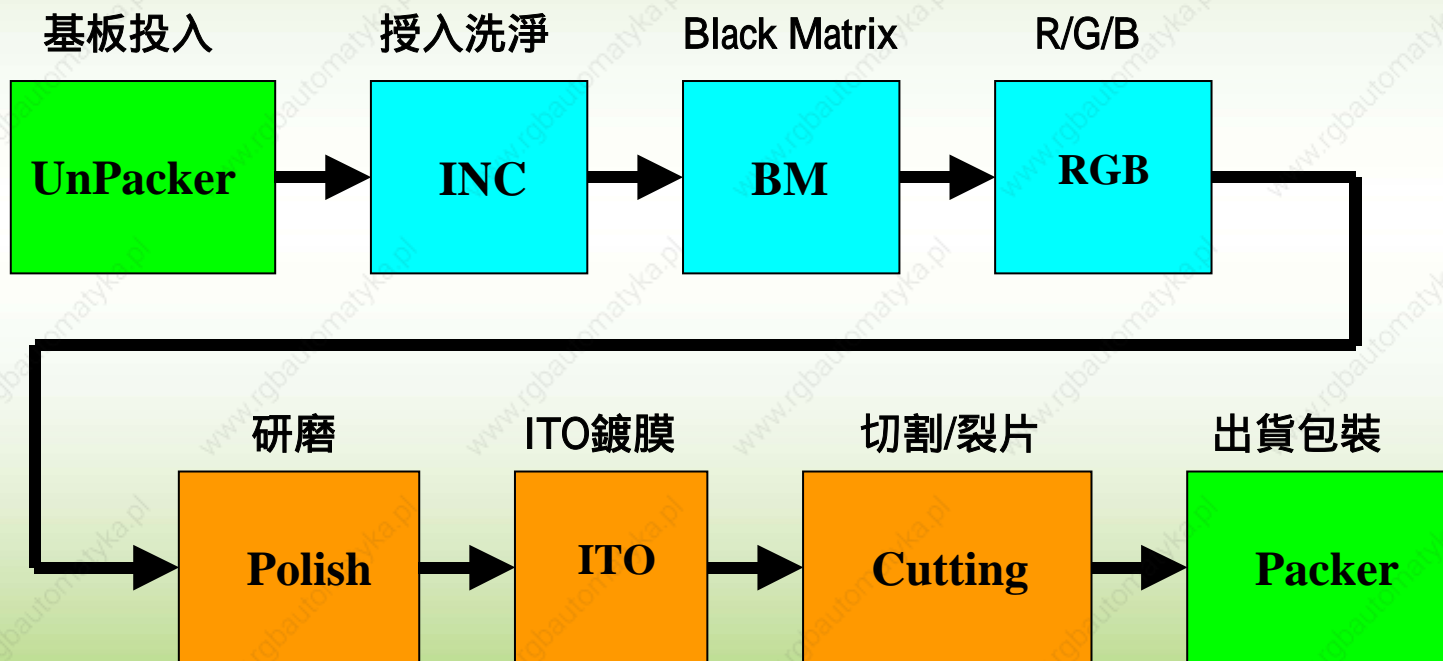
# TFT玻璃基板寫真

- TFT玻璃基板



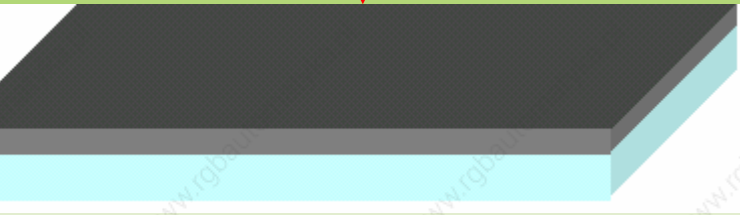


# Color Filter 的製造流程 (一)



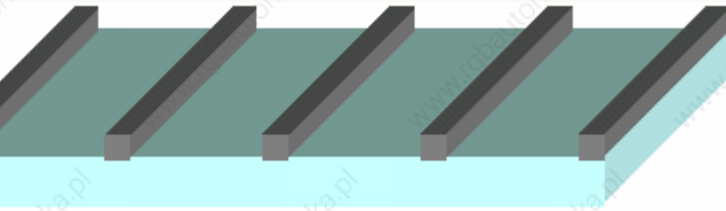
# Color Filter的製造流程 (二)

Cr Glass Input



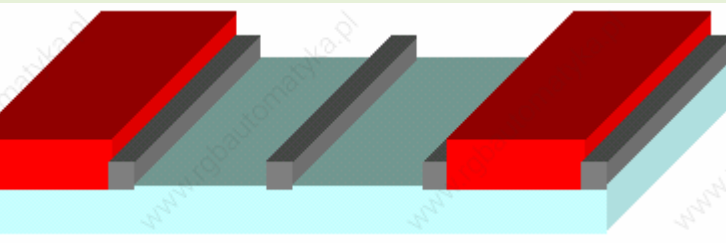
Black Matrix

Positive resist Coating, Dosing, Developing, Post-baking, Etching, Stripping.



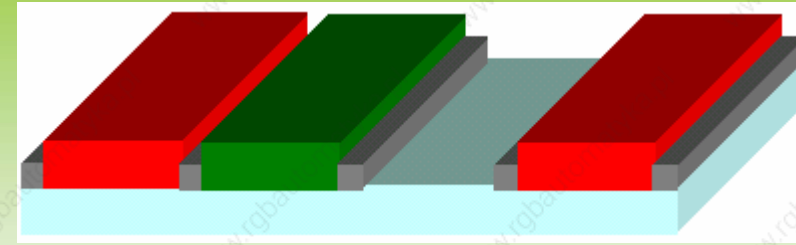
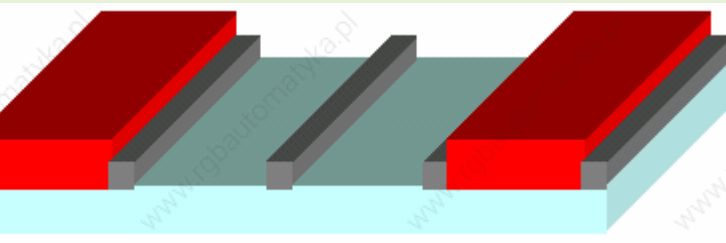
R sub-pixel

R Negative resist Coating, Dosing, Developing, Post-baking.



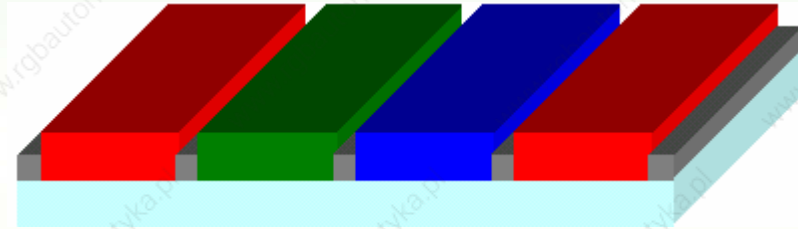
G sub-pixel

G Negative resist Coating, Dosing, Developing, Post-baking.

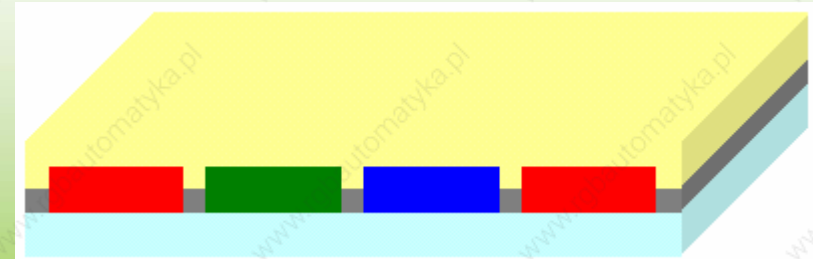


B sub-pixel

B Negative resist Coating, Dosing, Developing, Post-baking.



and then ITO

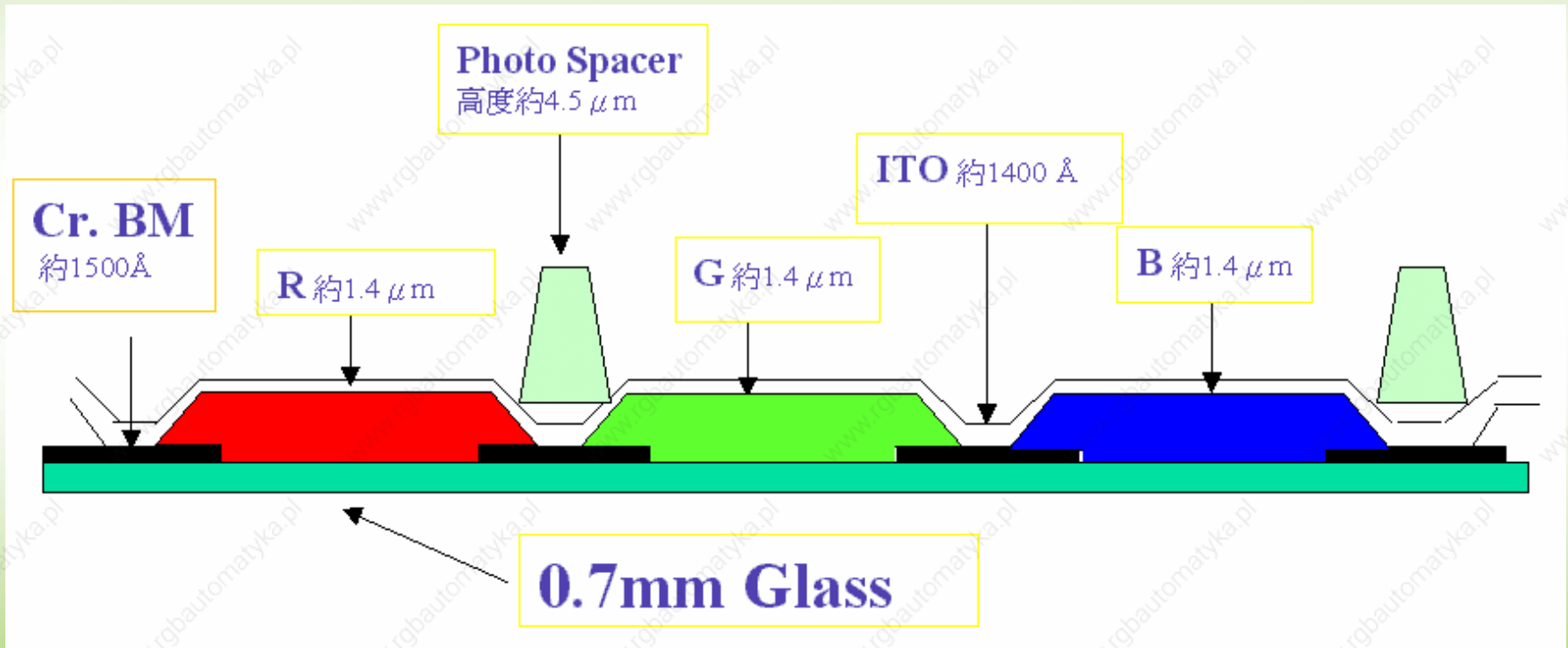


Cutting

Final Inspection

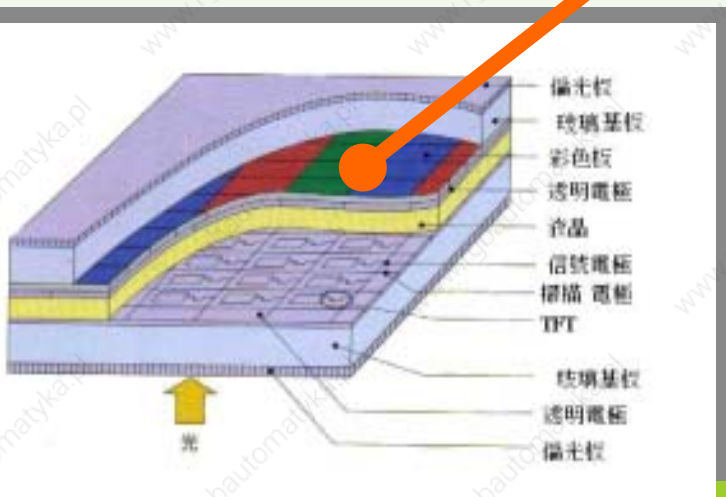
Color Filter Output

# Color Filter的Profile

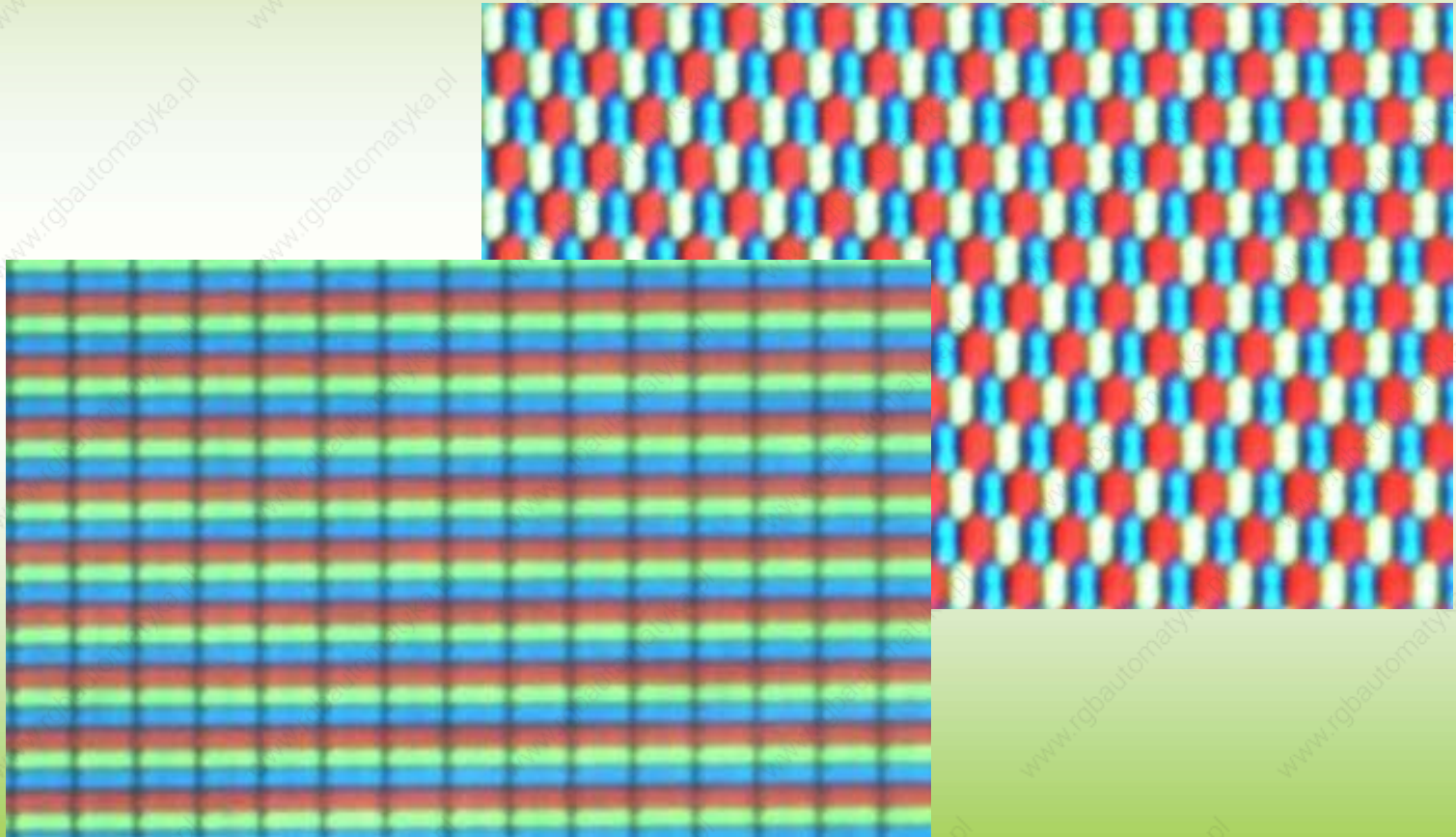


# CF玻璃基板寫真

- 彩色濾光片



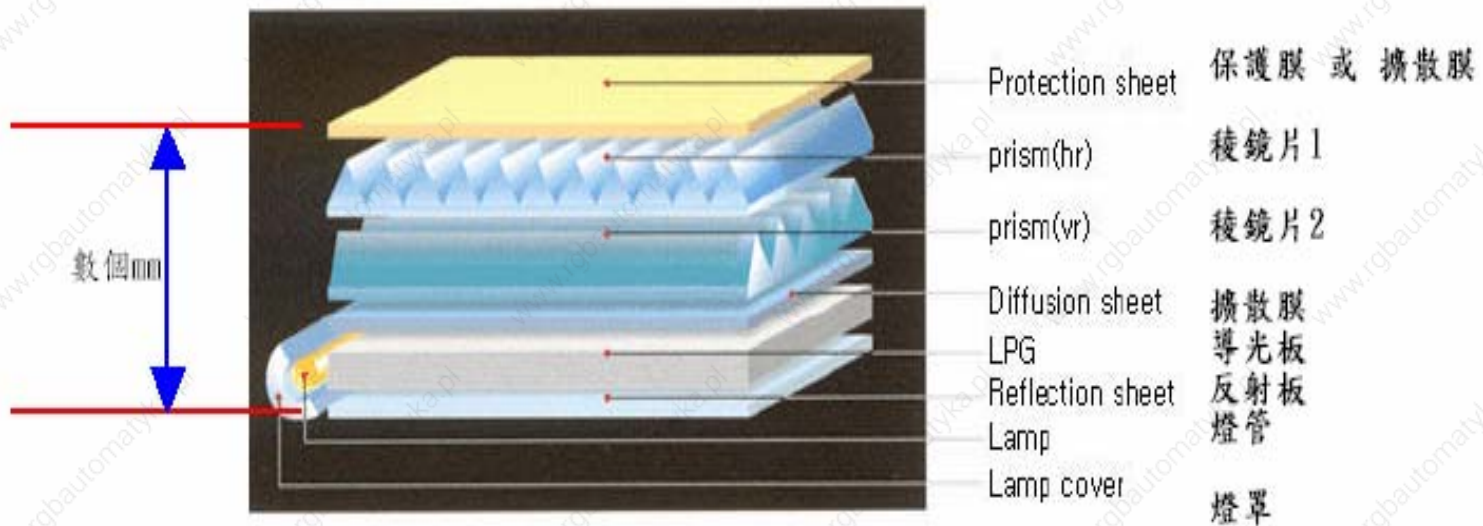
# 彩色濾光片RGB排列方式寫真



# LCD結構解析

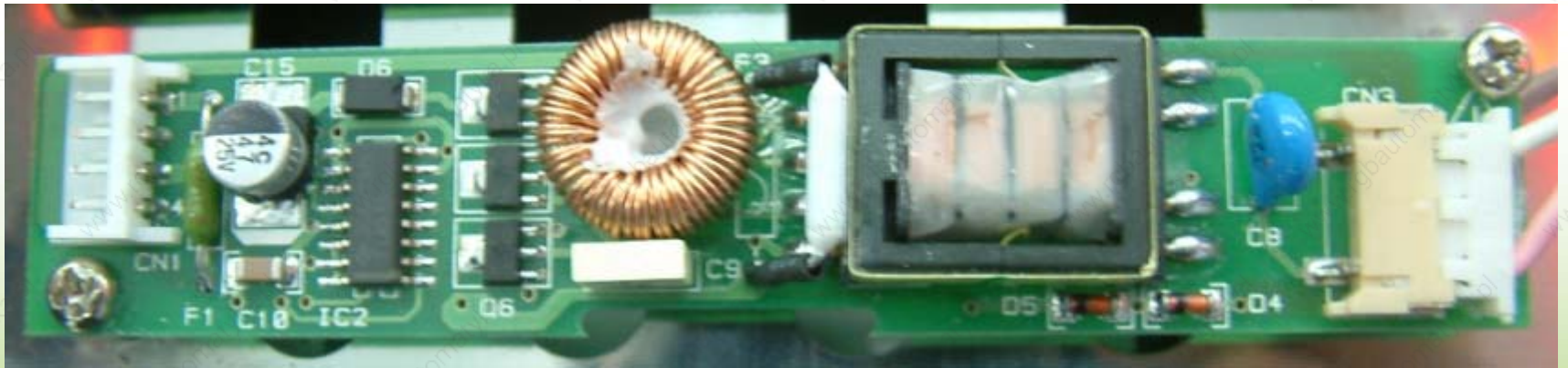
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# LCD背光模組



# 背光模組寫真

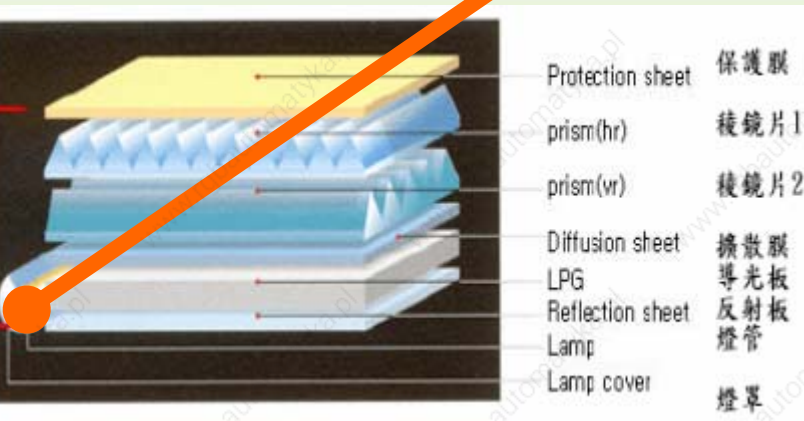
- CCFL驅動電路





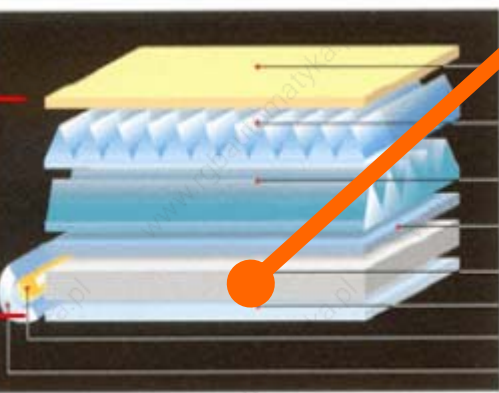
# 背光模組寫真

- 冷陰極管



# 背光模組寫真

- 導光板外觀



- |                  |      |
|------------------|------|
| Protection sheet | 保護膜  |
| prism(hr)        | 稜鏡片1 |
| prism(w)         | 稜鏡片2 |
| Diffusion sheet  | 擴散膜  |
| LPG              | 導光板  |
| Reflection sheet | 反射板  |
| Lamp             | 燈管   |
| Lamp cover       | 燈罩   |

# 背光模組寫真

- 導光板點矩陣

較密

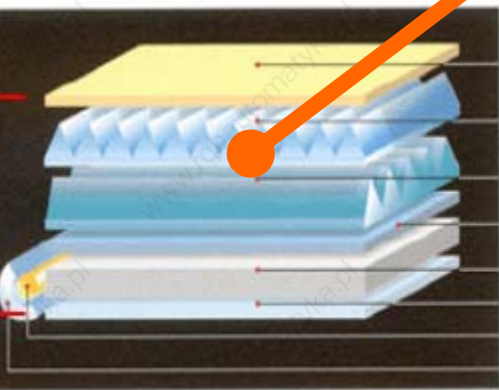


較疏

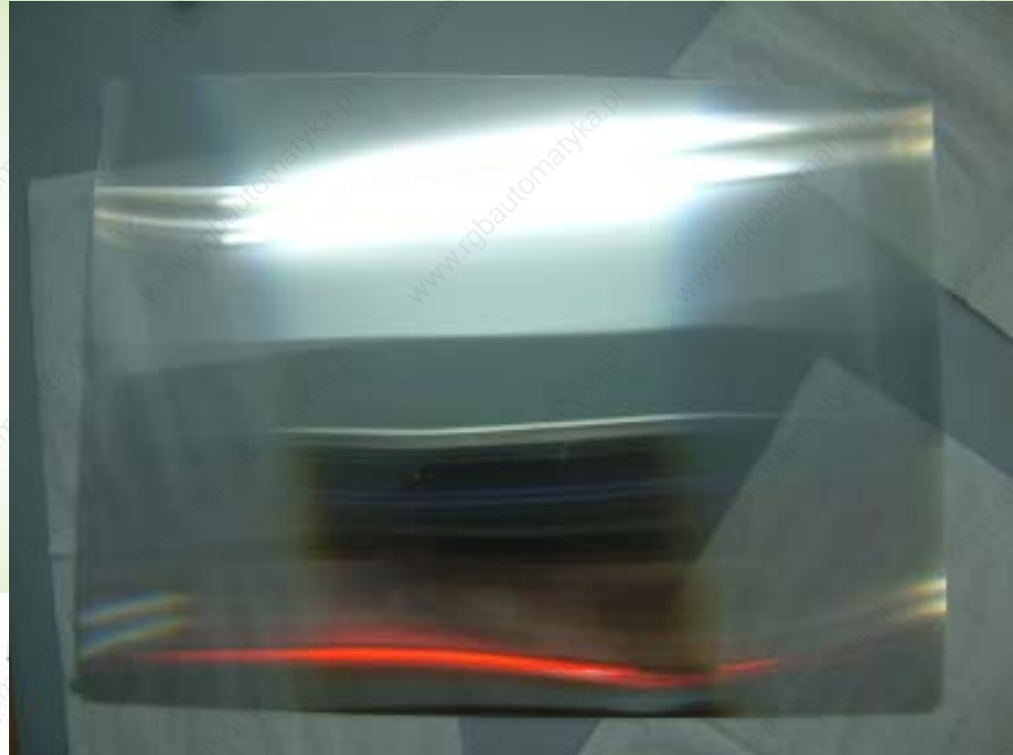


# 背光模組寫真

- 增亮膜



Protection sheet	保護膜
prism(hr)	稜鏡片1
prism(vr)	稜鏡片2
Diffusion sheet	擴散膜
LPG	導光板
Reflection sheet	反射板
Lamp	燈管
Lamp cover	燈罩



# 結論

- 拆解的困難度：
  - 液晶收集不易
  - TFT & CF的照片取得困難
- 感謝：
  - 老師指導拆解重點與場地設備提供
  - 同組夥伴,分工合作,順利完成報告

# Q & A

