高解析實境顯示於智慧育樂
跨領域應用教學聯盟

TAIWAN TECH
NATIONAL TAIWAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

高解析實境顯示基礎原理

Basic principles of high-resolution reality displays

莊智皓 助理研究員

臺灣科技大學 色彩科技研究中心

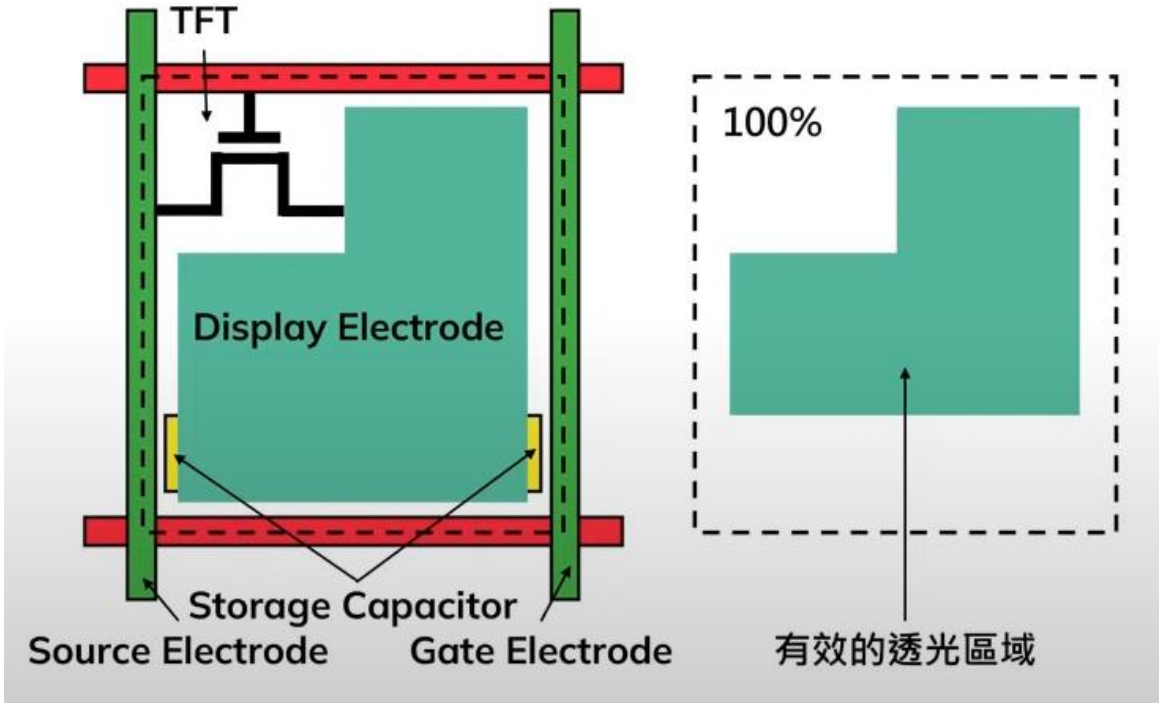
陳建宇 教授

臺灣科技大學 色彩與照明科技研究所

Chapter 5:高解析度液晶顯示的難點

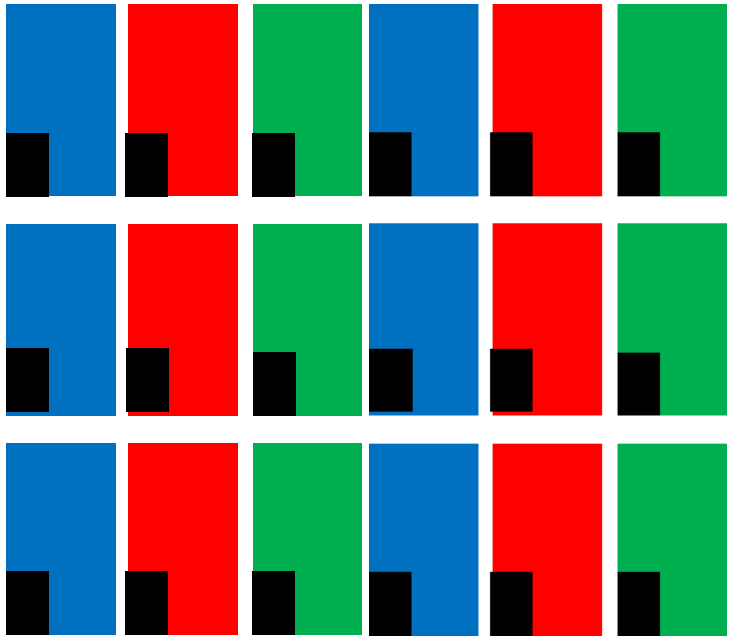
開口率

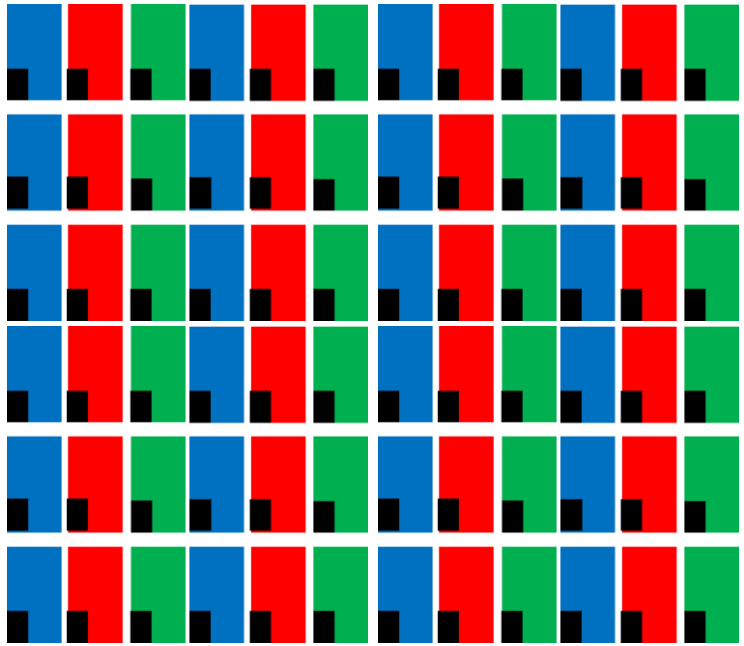
$$\text{開口率} = \frac{\text{透光區面積}}{\text{像素面積}} \times 100\%$$



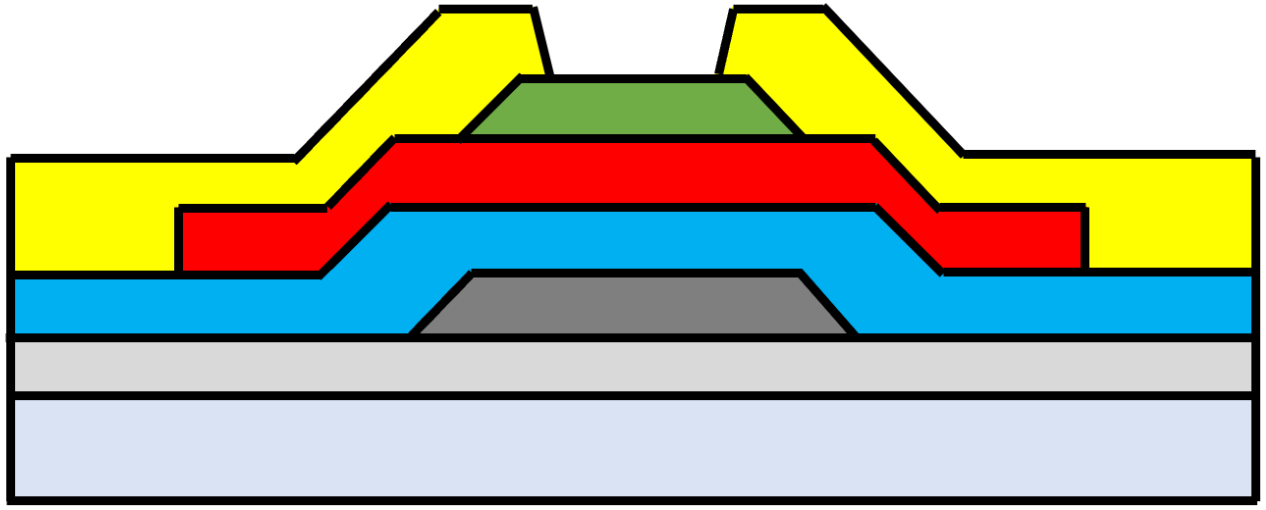
解析度上升帶來的問題

1. 開口率下降
2. 耗電量上升





薄膜電晶體(Thin-Film Transistor)



Glass
Buffer Layer
Gate Metal
Dielectric
Metal Oxide Semiconductor
Etch Stop
Source / Drain Metals

$$I_D = \frac{1}{2}\mu_n C_{ox}\frac{W}{L}(V_{GS} - V_{th})^2$$

載子遷移率

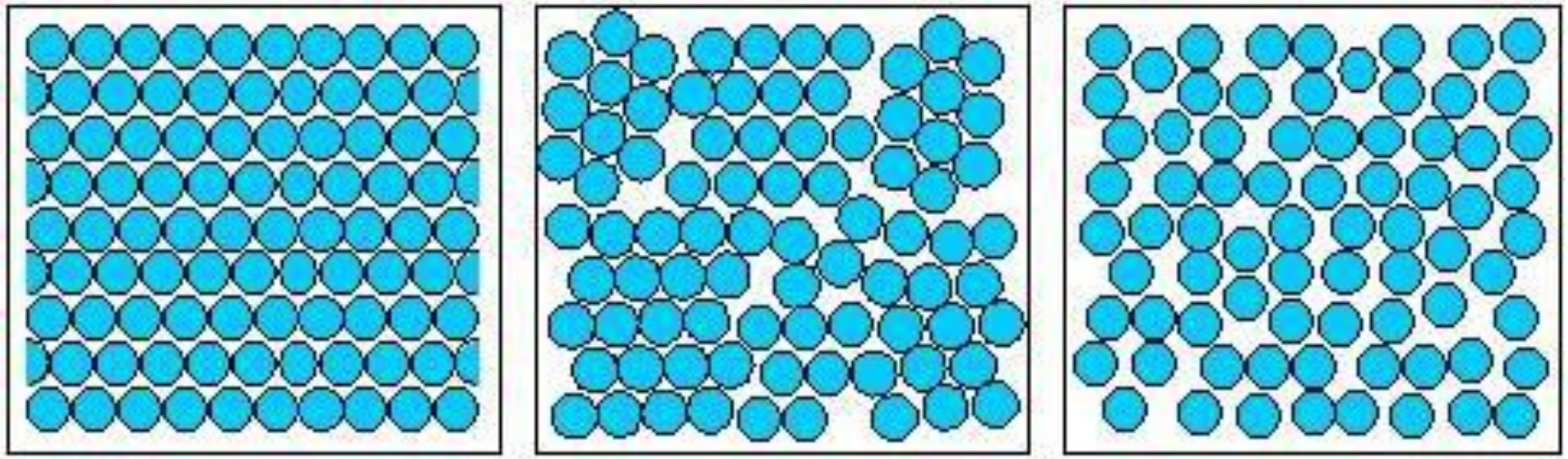
電子運動速度等於遷移率乘以電場強度，也就是說相同的電場強度下，載子遷移率越大，運動得越快；遷移率小，運動得慢。同一種半導體材料中，載子類型不同，遷移率不同。

遷移率主要的影響：

1. 電導率
2. 工作頻率

薄膜電晶體材料

材料縮減→需要更高載子遷移率的材料



Single crystal

Periodic across the whole volume.

單晶

Polycrystal

Periodic across each grain.

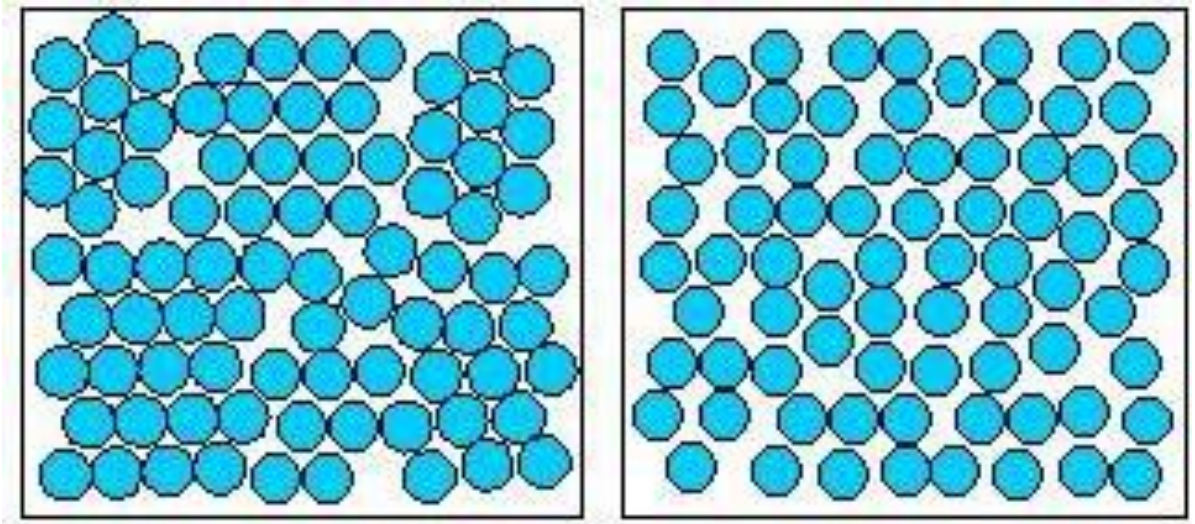
多晶

Amorphous solid

Not periodic.

非晶

薄膜電晶體材料



Polycrystal

Periodic across each grain.

Amorphous solid

Not periodic.

載子遷移率:

$100\ cm^2\ V^{-1}\ s^{-1}$

像素密度>300PPI

載子遷移率:

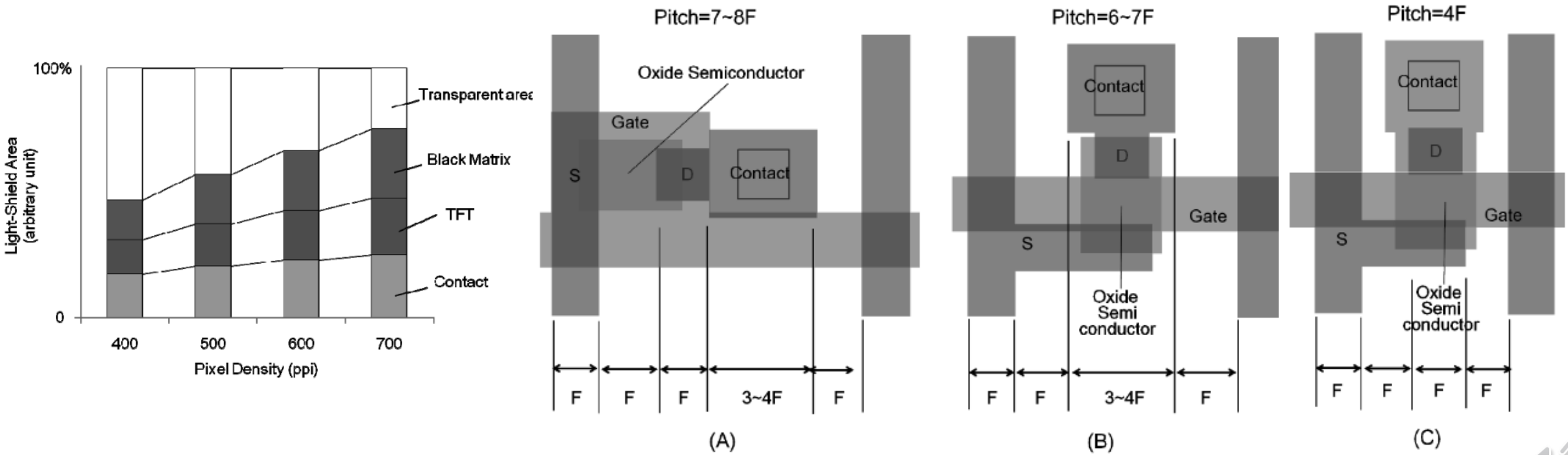
$0.5\sim1\ cm^2\ V^{-1}\ s^{-1}$

像素密度:200~300PPI

薄膜電晶體材料

Sharp Corporation

An Ultra High Density 736-ppi Liquid Crystal Display using InGaZnO Platform-SID 2018



薄膜電晶體材料

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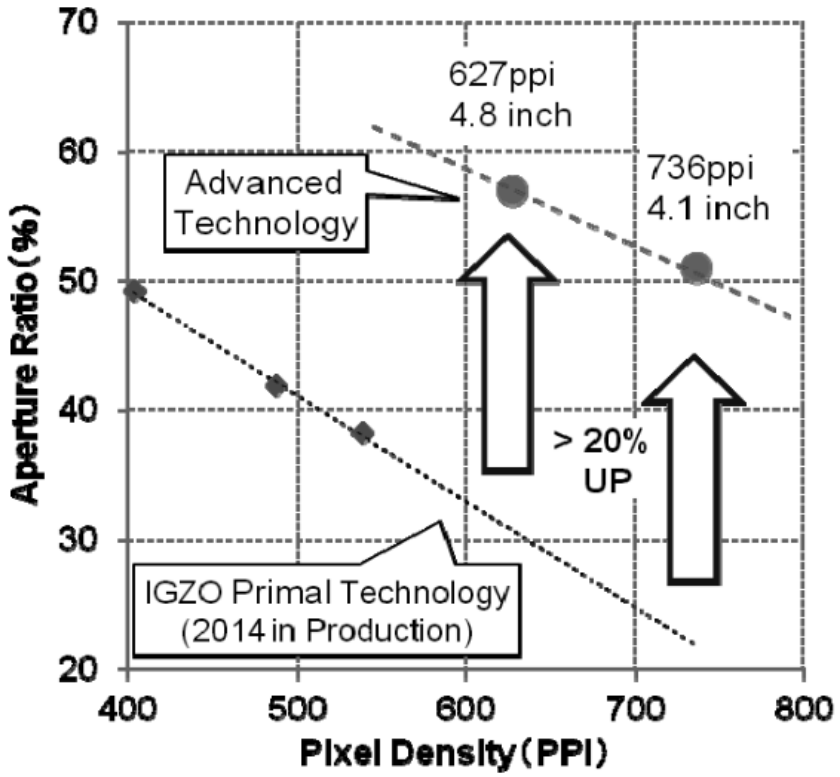

Panel Size	4.10 inch	4.80 inch
Resolution No. of pixels	WQXGA 2560 x 1600	
Resolution	736ppi	627ppi
Pitch size	11.5μm x RGB x 34.5μm	13.5μm x RGB x 40.5μm
Design Rule	LTPS mass-production equivalent	
TFT size (Channel W / L)	3um / 3.5um X 1	
Aperture Ratio	51%	57%
Bezel Width	–	0.9mm

Thank you for your attention