

有機發光二極體採用非晶態薄膜電晶體之驅動補償電路研究

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摘要

有機發光二極體(active matrix organic emitting diode, 簡稱 AMOLED)顯示器, 在近幾年來一直是大家討論研究的重要產業, 因為 OLED 具有自發光、廣視角(大於 170 度以上)、高對比度、反應時間快、高發光效率、低操作電壓、面板厚度薄、可製作大尺寸與可撻曲性面板及製程簡單等特性, 尤其製作成本低廉, 更是可望成為產業的明日之星。傳統的 AMOLED 顯示器的操作模式為兩個薄膜電晶體(thin film transistor, 簡稱 TFT), 分別作為開關與驅動元件, 另外搭配一個儲存電容, 然而無論使用非晶態薄膜電晶體(hydrogenated amorphous TFTs, 簡稱 a-TFT:H), 或者是低溫複晶態薄膜電晶體(low temperature poly TFTs, 簡稱 LTPS), 都有其無法克服的缺點; LTPS 本身電流雖然比較大, 電子遷移率高, 使得元件尺寸可以縮小, 提升開口率, 降低操作電壓, 達到省電目的, 但其製程成本較高, 而且均勻度非常低, 這致命的缺點, 使得 LTPS 應用在大面板上, 顯得困難

重重；另一方面，a-TFT:H 擁有較高的均勻度和較低的製程成本，成爲其優勢，然而 a-TFT:H 本身特性並不穩定，在長時間操作下，驅動元件(driving TFT)會因爲劣化造成門檻電壓(threshold voltage)的漂移，使得整個驅動電流越來越小，面板壽命變短，成爲 a-TFT 的最大罩門，此外 OLED 本身也會因爲長時間操作下造成劣化，因此用以補償門檻電壓與 OLED 電壓的驅動電路被大家普遍研究中

在本篇論文，提出了兩種驅動補償電路，使用 amorphous TFT 作爲我的驅動元件，利用 amorphous 元件的優點：均勻、低成本、製程簡單，再配合此兩種補償電路，將門檻電壓及 OLED 變動的特性加以改善，另外，針對一般普遍電壓補償電路的缺失，加以改進，以其有效改善畫面亮度不均勻，以及可靠度不佳的問題，大幅改善大型顯示器面板特性。

Enhancement of OLED compensation pixel circuit using amorphous TFTs

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Abstract

Active matrix organic emitting diode (AMOLED) display panels have recently attracted much attention. Because OLED has significant advantages : self-illuminance, high contrast ratio, wide viewing angle (more than 170 degree), fast response time, high illuminant efficiency , low operation voltage, thin, flexible and simple fabrication. Furthermore, low cost of fabrication is regarded as best potential in production fields. Operation of conventional AMOLED display panels are two thin film transistors (TFTs) , which are individually for switching and driving function, and one storage capacitor. However, no matter hydrogenated amorphous TFTs (a-TFTs:H) or low temperature poly TFTs (LTPS) we use, there are their own obstacles. The significant advantages over LTPS are high driving current, mobility and large aperture ratio. Lower operation voltage makes power conservation. But higher cost on fabrication and lower uniformity makes it difficult to apply in large and high resolution panels. On the contrary, the advantage over LTPS are in the higher uniformity and lower fabrication cost. Nevertheless, a-TFT:H

itself is in the worse reliability. After long time operation, the driving a-TFT:H would degrades to cause threshold voltage shift. The driving current becomes lower and lower. These are the most significant drawbacks of a-TFT:H. Furthermore, OLED itself also degrades after long time stress. As a consequence, compensation pixel circuits for threshold voltage shifts and OLED degradation have been extensively studied.

In this thesis, we are introducing two voltage-programmed compensation pixel circuits with a-TFTs:H. We are looking forward to utilizing advantages of a-TFTs:H : uniformity, low cost and simple fabrication and cooperating our compensation pixel circuit to significantly enhance stability and uniform brightness of AMOLED display panels. The simulation results indicate that these proposed circuits successfully compensate for the threshold voltage shift of a-TFTs:H.

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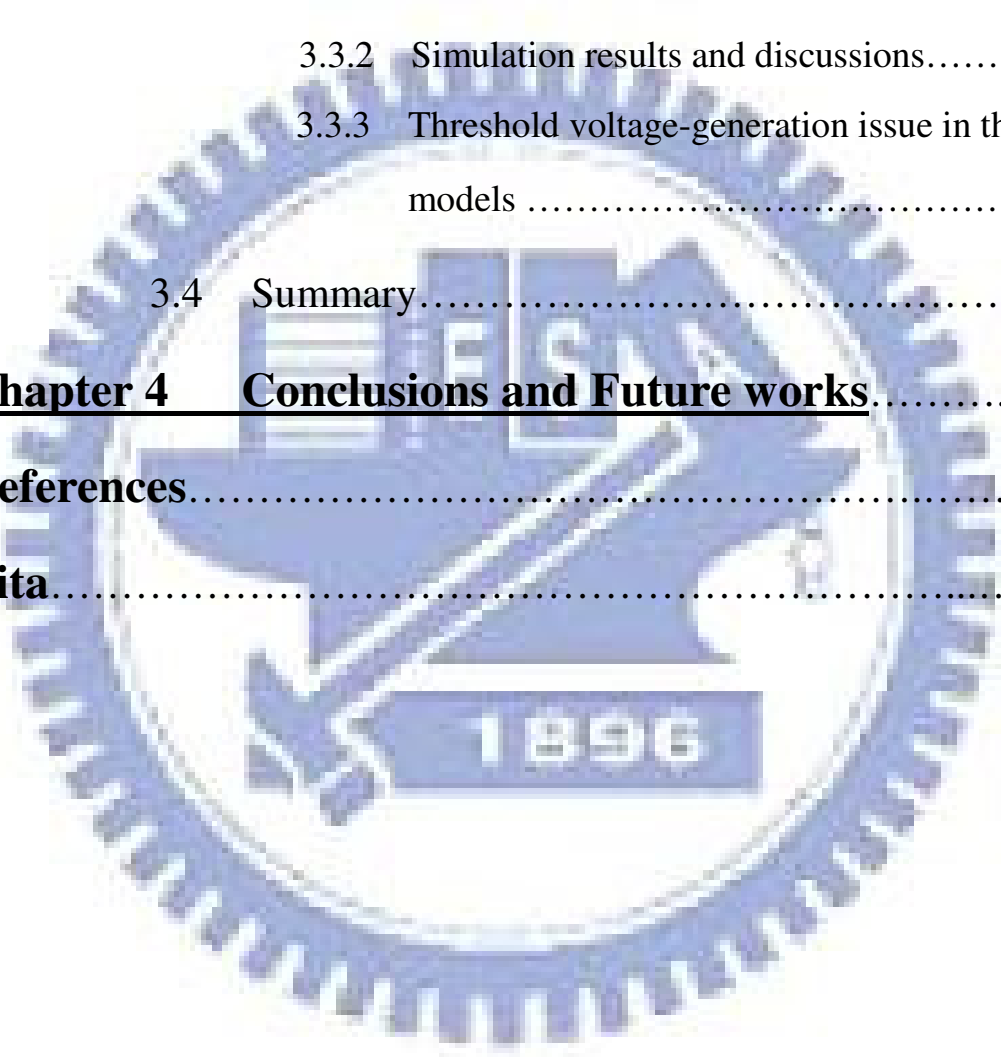


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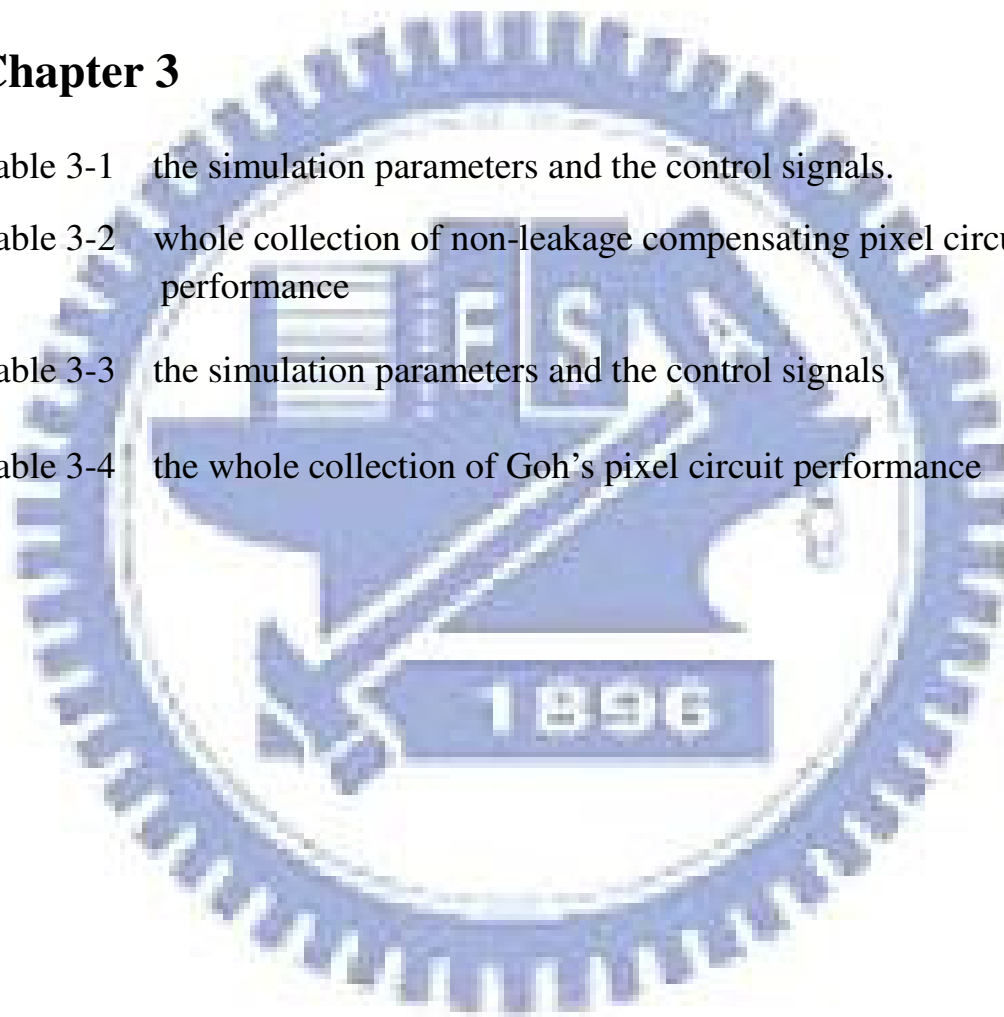


Figure Captions

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