OLED WITH SELF COMPENSATION

HP INC
OLED with self compensation

Abstract
This invention discloses a new structure and approach to detect and compensate OLED non-uniformity issue, including image sticking. On the TFT backplane, there are driving TFT and sensing TFT. During OLED light on, while most light goes to top direction to the user, a small amount of light goes to sensing TFT and be detected. There by comparing the level of the response of each sensing TFT, system is able to know the luminous difference of each pixel. And then, adjust the appropriate driving voltage to make the luminous closer. This will minimize the image sticking.

Background
OLED displays are expected to be dominant of next generation displays. They have many advantages compared to conventional displays like LCD, including thin and light, fast response time, high contrast ratio, better color gamut, and many others. However, one of the key concerns on OLED is the image sticking issue. This is because in OLED display, each pixel is an individual LED. After some time of operation, each suffers different levels of accumulated stress, and thus decay differently. And therefore, the luminous of each pixel become different.

One of the prior solutions to solve image sticking issue is to build the database of OLED decay curve first, then record the loading of each pixel, then based on the database to compensate each pixel to similar brightness. However, even with such compensation approach, image sticking can still be observed from a real sample. The problem may be originated from step 1, i.e., the database is not always accurate. This is because piece to piece, lot to lot variations. Not all the OLED panels follow the same OLED decay curve from the database.

Invention Description
In the conventional OLED structure, there is driving TFT to supply current to OLED device via anode electrode, and thus OLED emit light. In the conventional OLED structure, we fabricated a sensing TFT together with the driving TFT on the same substrate. When OLED light on, a small part of light leak to bottom side and the sensing TFT can detect it. By comparing the level of the response of each sensing TFT, system is able to know the luminous difference of each pixel. And then, adjust the appropriate driving voltage to make the luminous closer. There by minimize the image sticking.

Figure 1. Cross section of the proposed display sensing TFTs fabricated together with driving TFTs.
Advantages

- The fabrication processing steps is the same as conventional structure, because the sensing TFT can be made together with driving TFT on the same substrate. Therefore the cost adder is very minimum.
- The compensation can be automatic by just comparing the sensing TFT response of each pixel.
- No pre-built OLED database is required. This will eliminate the effects of panel to panel variations.
- The timing of compensation can be done manually or automatically (judged by system).
- This approach also works for other non-uniformity issue of OLED display.

*Disclosed by Hsing-Hung Hsieh, Kuan-Ting Wu, HP Inc.*