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(54) **Titre :** ARCHITECTURE DE PIXELS HAUTE RESOLUTION
(54) **Title:** HIGH RESLUTION PIXEL ARCHITECTURE

(57) **Abrégé/Abstract:**
Disclosed is a technique to improve the aperture ratio for bottom and top emission displays. Here, the pixel architecture is made less dependent on the backplane and the emission design rules.

ABSTRACT

Disclosed is a technique to improve the aperture ratio for bottom and top emission displays. Here, the pixel architecture is made less dependent on the backplane and the emission design rules.

FIELD OF THE INVENTION

The present invention generally relates to aperture ratio of displays particularly light emitting displays.

SUMMARY OF INVENTION

Here, the aperture ratio is improved through using the blocked area and also changing the pixel architecture. The light is guided from the area that is blocked by driver and metals to the opening window. As a result, the aperture ratio is much larger than actual opening. The other method is re-arranging the pixel structure to make the pixel opening less dependent to the fabrication design rules.

ADVANTAGES

This technique allows fabrication of high resolution displays while results in reasonable aperture ratio without the need for a high resolution fabrication process. Consequently, the use of shadow masks becomes possible, or even easier, for partitioning the pixel for high pixel density pixels.

FIG.1 shows the conventional RGB strip pixel architecture.

FIG.2 (a) is the staggered color patterning for RGB bottom emission structure.

FIG.2 (b) is the staggered color patterning for RGBW bottom emission structure.

FIG. 3 demonstrates the staggered color patterning for RGB top emission structure.

FIG. 4 highlights the aperture ratio for bottom emission display.

FIG. 5 signifies the effect of staggered color patterning on the aperture ratio for top emission display.

FIG. 6 shows another embodiment of the staggered color patterning.

FIG. 7 shows the conventional OLED opening and OLED pixel coverage.

FIG. 8 shows the improved OLED opening and OLED pixel coverage.

FIG.1 shows the conventional RGB stripe. For shadow masking, the distance between two adjacent OLED and the OLED size is significant (larger than 20 um). As a result, for high resolution display (e.g. 253 ppi with 33.5 u sub pixel width), the aperture ratio will be very low.

In **FIG. 2**, the row is divided into two sub rows. Also, the OLEDs are put on top and bottom side of the pixel alternatively. As a result, the distance between the two adjacent OLED will be larger than the minimum required distance. Also, the VDATA line can be shared between two adjacent pixels. This will result in a large aperture ratio. **FIG. 2(a)** shows the staggered architecture for RGB bottom emission display whereas **FIG. 2(b)** demonstrates the staggered architecture for RGBW bottom emission displays.

Also, the same technique as what demonstrated in **FIG. 2** can be used for the top emission. **FIG. 3** shows the staggered color patterning for RGB top-emission display structure. In this case, sharing the VDATA in top emission structure can lead to more area for the drive TFT. As a result, the drive TFT can be large and so the aging will be slower.

Aperture ration for different display resolution is demonstrated in **FIG. 4**. Here, the assumption is that shadow mask is used for OLED patterning and the gap between two adjacent OLED should be larger than 20 µm. While the aperture ration for higher resolution using RGB stripe is zero, the aperture ration of new staggered pixel architecture (IGNIS HR pixel architecture) is higher than 20% for up to 260 PPI.

FIG. 5 shows the aperture ratio for top emission displays. Here, the aperture ration is extracted for two type of OLED patterning (shadow mask with 20-µm gap and LITI with 10-µm gap). In the case of shadow mask, the aperture ratio for RGB stripe is limited by OLED design rules where RGB stripe using LITI is limited by the TFT design rules. However, for both cases, staggered color patterning can provide high resolution (e.g. 300 ppi) with large aperture ratio without mandating tighter design rules.

FIG. 6 shows another pixel arrangement for improving the aperture ratio and relaxing the OLED manufacturing requirement. In this structure, any single current is within one sub-row. As a result, the lines looks more straights and so provide better quality for text.

FIG. 7 shows the cross section for the conventional bottom emission structure. The OLED area is limited by the opening window. In this case, the current density is high, and so the OLED voltage is high. As a result, the power consumption is higher and the OLED lifetime is reduced.

FIG. 8 shows the cross section of the extended OLED for bottom emission. Here, the OLED area is not limited to the opening window. As a result, the OLED current density for a given luminance is low. This will result in lower OLED voltage leading to lower power consumption. Moreover, the OLED lifetime will be longer due to lower current density

Application number/numéro de demande: 02686174

Figures: 1, 2(a), 2(b), 3, 6

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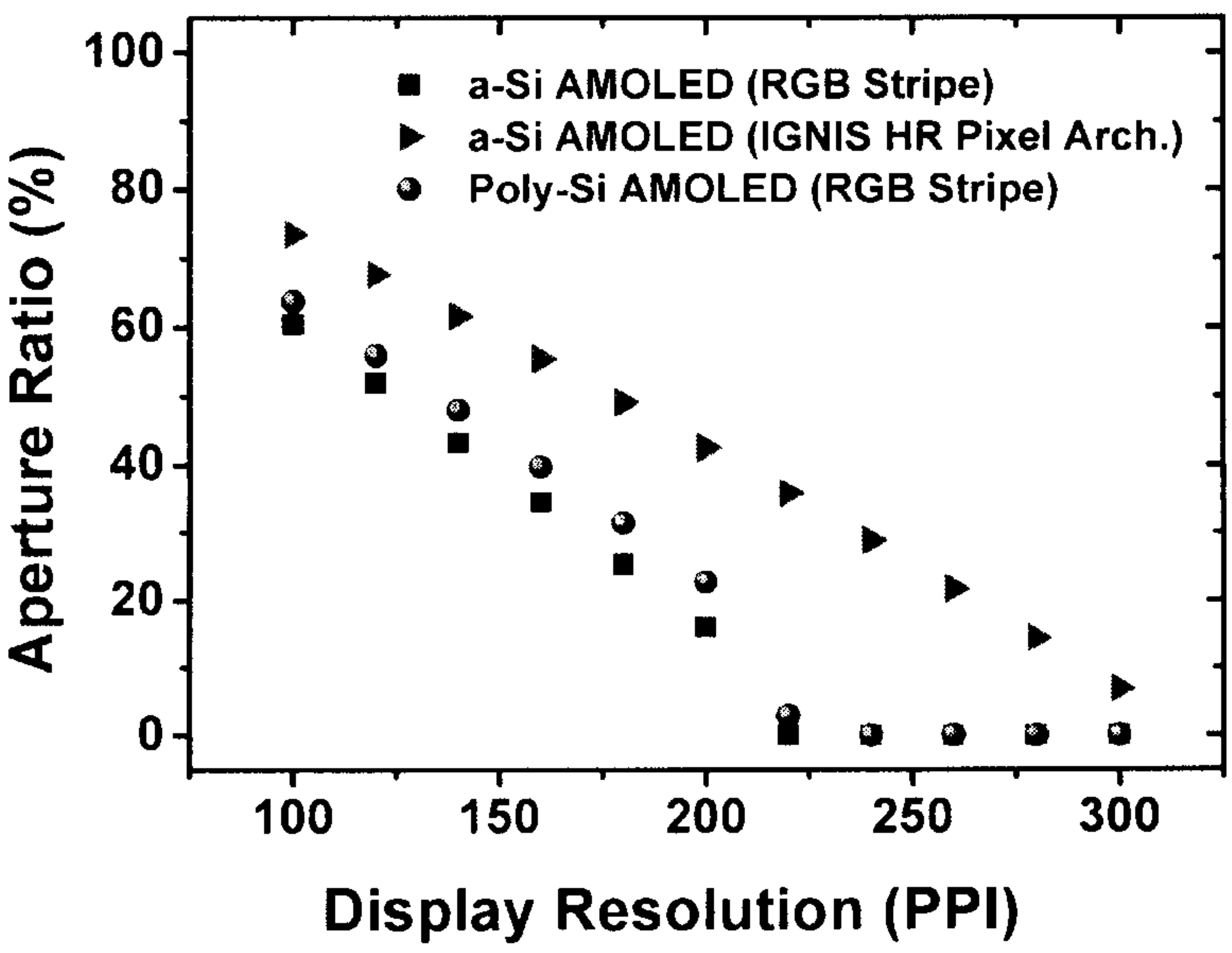
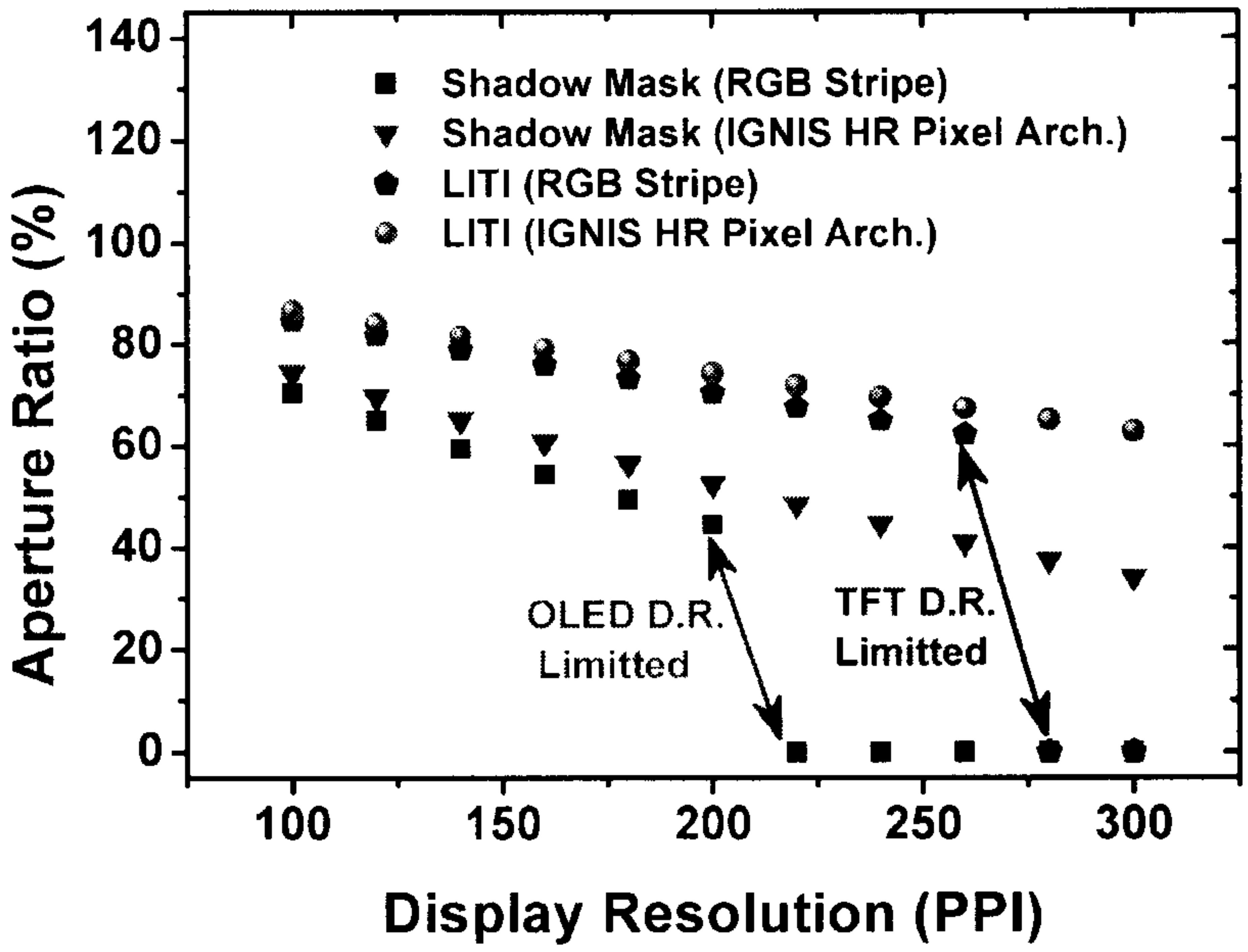


a-Si AMOLED (RGB Stripe)
a-Si AMOLED (IGNIS HR Pixel Arch.)
Poly-Si AMOLED (RGB Stripe)
Aperture Ratio (%)
100
80
60
40
20
0
100
150
200
250
300
Display Resolution (PPI)

FIG. 4



Shadow Mask (RGB Stripe)
Shadow Mask (IGNIS HR Pixel Arch.)
LITI (RGB Stripe)
LITI (IGNIS HR Pixel Arch.)
Aperture Ratio (%)
140
120
100
80
60
40
20
0
OLED D.R. Limitted
TFT D.R. Limitted
100
150
200
250
300
Display Resolution (PPI)

FIG. 5

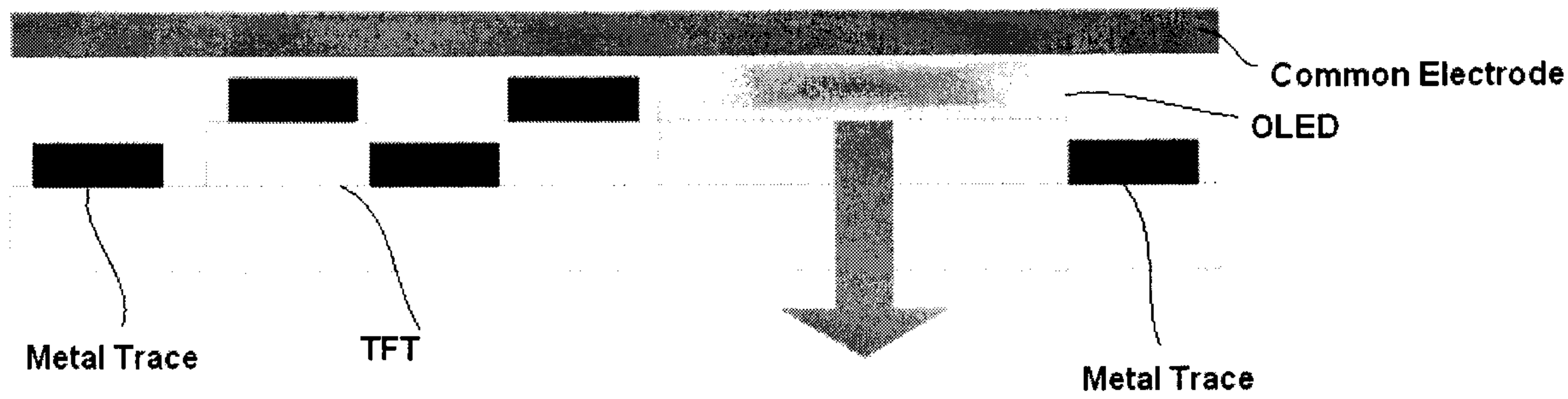


FIG. 7

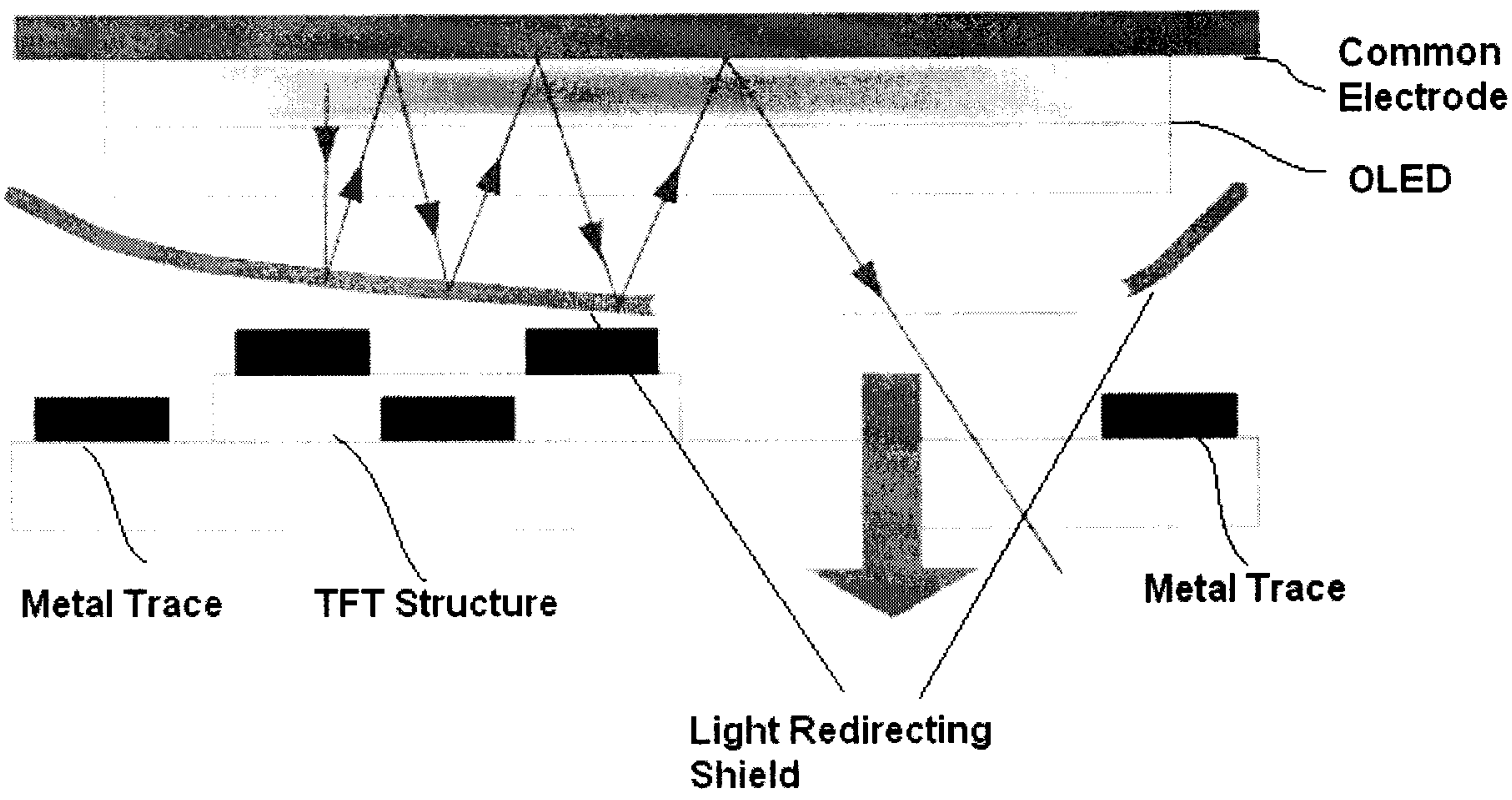

Common
Electrode
OLED
Metal Trace
TFT Structure
Metal Trace
Light Redirecting
Shield

FIG. 8