Middle and Large Sized AMOLED Manufacturing Process Report

Ver. 6

2024

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1. AMOLED structure

1.1 Panel structure for TV

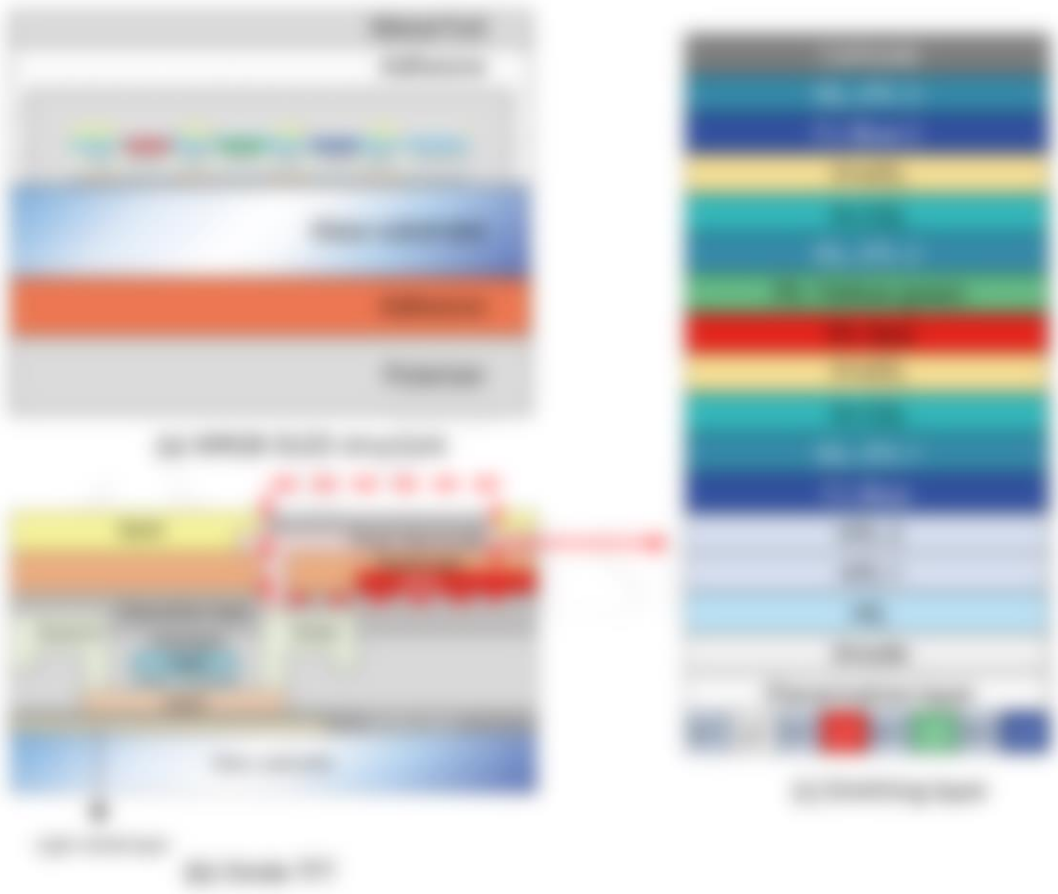
WRGB OLED panel

· WRGB OLED, which is being mass-produced, has a polarizer attached below the backplane and has a bottom-emitting structure with OLED and encapsulation formed on the top of the TFT.

· The backplane uses oxide TFT, and the OLED has a 3-stack structure of WOLED + color filter method.

· Encapsulation is a hybrid encapsulation method that deposits an inorganic material layer and then bonds the metal foil and the substrate on which the device is formed with adhesive.

WRGB OLED panel structure



1. AMOLED structure

1.1 Panel structure for TV

QD-OLED panel

· The OLED pixel has a 4-stack structure and emits light from the front in the opposite direction of the TFT structure.

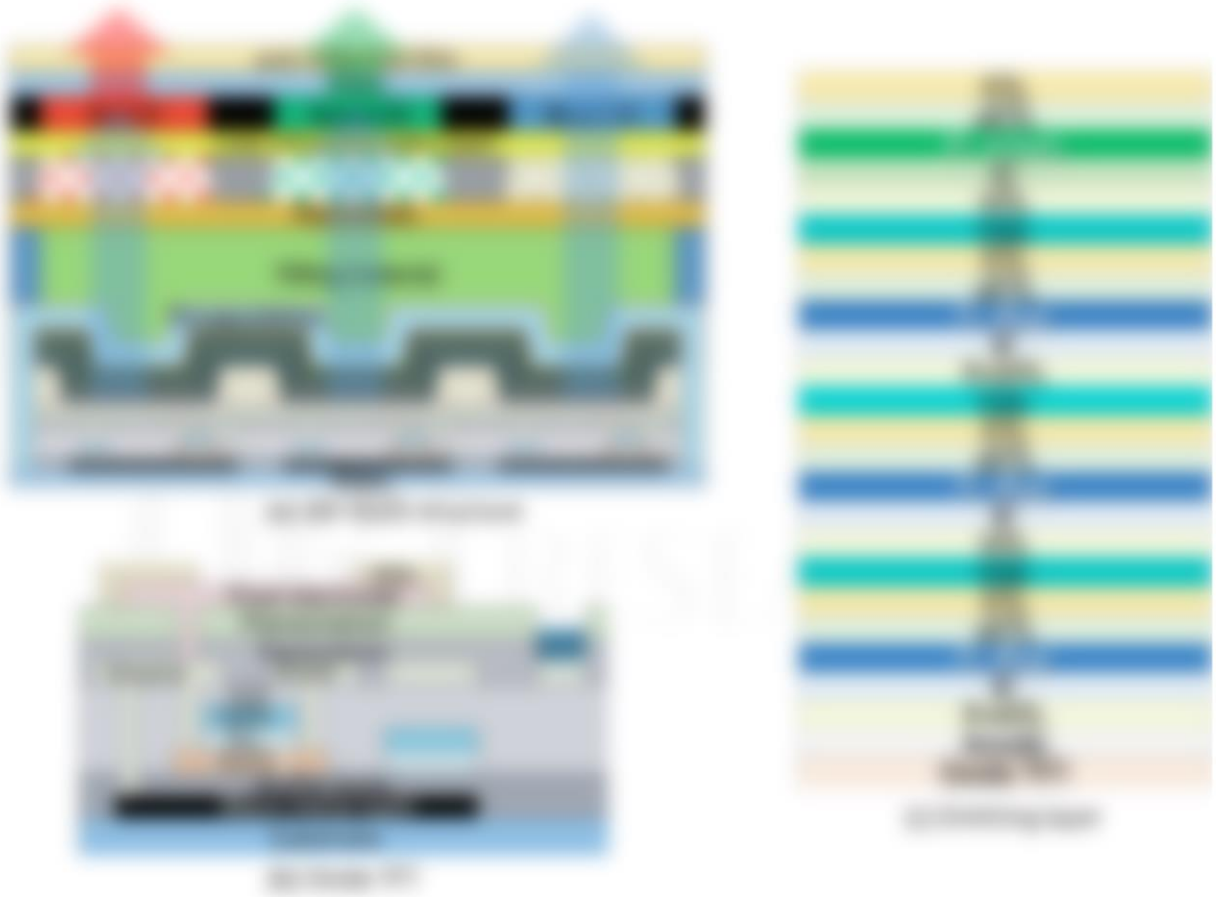
· The light emitting structure is based on the QM2 standard applied from the end of 2022.

· A color filter is applied to prevent emission of QD material caused by external incident light.

· A low refractive index layer was added between the color filter and QD to improve brightness.

· Instead of a polarizer, the top substrate has an anti reflect film to prevent external light reflection.

Structure of QD-OLED



2. TFT manufacturing process

2.1 Apple LTPO TFT manufacturing process

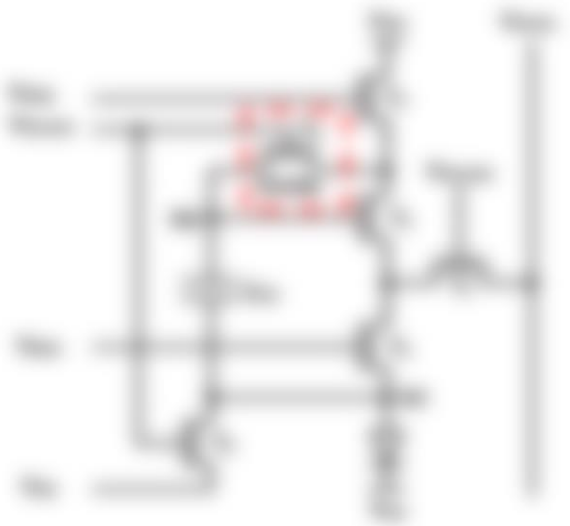
· Analyzed (decapsulated) Apple Watch 5 and organized the basic structure and process .

· Since the process was analyzed based on the LTPO TFT on which decap was performed , the re may be differences from the actual mask process .

· The light shield layer on the PI substrate reduces stress on the TFT and acts as a capacitor, and the light shield layer connected to the S/D electrode is assumed to act as a light shield and capacitor .

Apple LTPO TFT Structure

LTPO TFT pixel circuit diagram announced by Apple (for reference only)



2. TFT manufacturing process

2.2 SDC HOP(LTPO) TFT manufacturing process

· Analyzed the basic structure and process of the LTPO TFT applied to the Galaxy Note20 Ultra .

· Because the process was analyzed by decapturing the actual structure, there may be differences from the actual process .

HOP(LTPO) TFT structure

HOP(LTPO) TFT pixel circuit

2. TFT manufacturing process

2.3 Oxide TFT basic manufacturing process

Oxide TFT process sequence

2.4 LGD OLED TV Oxide TFT manufacturing process (including MLA)

Oxide TFT 8 mask manufacturing process

- There is a light shield layer on the bottom of the gate metal to block light due to the bottom emitting structure.

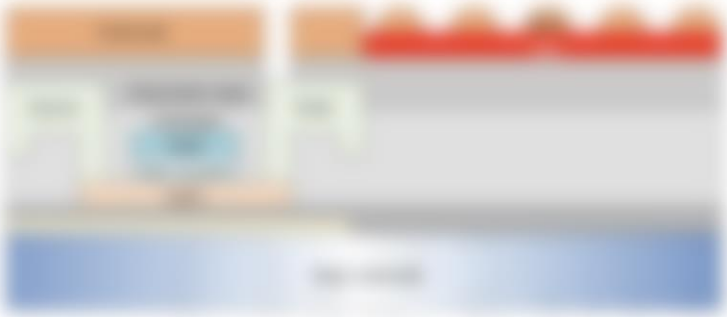
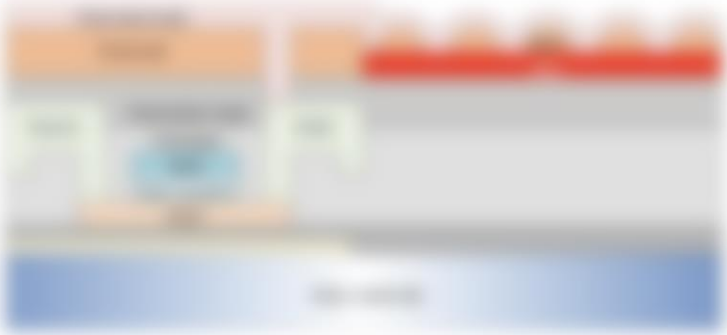
- Basically, it is composed of 8 masks of oxide TFT and 3 masks of color filter.

- Recently, some models have been reduced to a 7-mask process with a light shield and data electrode in one layer.

2.4 LGD OLED TV Oxide TFT manufacturing process (including MLA)

· Overcoat and passivation layer patterning (mask #6)

Oxide TFT manufacturing process and equipment

Process	Materials	Equipment
		
		
		

3.2 QD-OLED manufacturing process

Encapsulation process

Thin film encapsulation process and equipment

Process	Materials	Equipment
		
		
		
		

3. OLED pixel and encapsulation manufacturing proces

3.4 Photolitho OLED (Applied Materials, eLEAP, VIP) Manufacturing Process

OLED pixel and encapsulation process

3.4 Photolitho OLED (Applied Materials, eLEAP, VIP) Manufacturing Process

OLED pixel and encapsulation process

OLED pixel and encapsulation process and equipment

Process	Materials	Equipment
		
		
		
		

3. OLED pixel and encapsulation manufacturing proces

3.5 Photolithography OLED (Semiconductor Energy Laboratory) Manufacturing Process

OLED pixel and encapsulation process

3.5 Photolithography OLED (Semiconductor Energy Laboratory) Manufacturing Process

OLED pixel process

OLED pixel process and equipment

Process	Materials	Equipment
		
		
		
		

4.2 QD-OLED sealing process

Upper and lower plate sealing process (Dam & Fill)

Sealing process and equipment

Process	Materials	Equipment