

# 2021 OLED Components and Materials Report

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<b>1. Key Summary</b> .....	<b>3</b>	<b>5. Analysis and Forecast of OLED Panel Makers' Mass Production Capacity</b>	<b>75</b>
<b>2. Analysis of The Latest Development Trend of OLED</b> .....	<b>5</b>	5.1 Annual Total Substrate Area Forecast	
2.1 Overview		5.2 Small OLED Annual Substrate Area Forecast	
2.2 LTPO TFT		5.3 Mid-to-large OLED Annual Substrate Area Forecast	
2.3 High refractive CPL		<b>6. OLED Shipment Forecast</b> .....	<b>80</b>
2.4 Micro Lens Array		6.1 OLED Total Shipments	
2.5 Pol-less		6.2 Shipments by Application	
2.6 Under Panel Camera		6.3 OLED Shipments for Smartphones	
<b>3. Development of Components and Materials for Foldable Devices and Industry Status</b> .....	<b>17</b>	<b>7. Major Components and Materials Market Forecast</b> .....	<b>86</b>
3.1 Foldable Device Development Trend		7.1 Overview	
3.2 Analysis of OLED Structure for Foldable Devices		7.2 Total Market	
3.3 Foldable OLED Business and Exhibition Trends by Panel Maker		7.3 Substrate	
3.4 Ultra Thin Glass		7.4 TFT	
3.5 Colorless PI		7.5 Encapsulation	
3.6 Low Reflection Film		7.6 Touch sensor	
<b>4. Components and Materials Development and Industry Status for TV</b> ....	<b>71</b>	7.7 Polarizer	
4.1 QD-OLED		7.8 Adhesive	
4.2 Oxide TFT		7.9 Cover Window	
		7.10 Driver IC & COF	
		7.11 Composite Sheet	
		7.12 Process Film	

# 2. Analysis of The Latest Development Trend of OLED

## 2.1 Overview

### Low-power drive technology

- Recently, as watching videos, playing games, and processing work for a long time on mobile devices has become commonplace, battery consumption in mobile devices has become an issue. As the resolution of a mobile device increases, the pixel size decreases, and more power is consumed than a low-resolution OLED to maintain a constant luminance.
- For low-power driving of OLED, Samsung Display is applying or developing the following technologies.

Samsung Display's low-power driving technology development example

Technology	LTPO TFT	High refractive index CPL	Micro lens array	Pol-less
Explanation	Combining LTPO TFT and oxide TFT technology	Application of CPL with higher refractive index than before	Micro lens applied on the top of the touch electrode	Polarizer removal and color filter, black PDL, and anti-reflect technology applied
Effect	Total power consumption reduction through reduction of driving current	Increased external quantum efficiency	Increased external quantum efficiency	Increased external quantum efficiency
Application Model	Galaxy Note 20 Ultra, Galaxy Z Fold2, Galaxy S21 Ultra	Galaxy S10 series~ (M9,M10,M11)	Galaxy Note 20 Ultra	Galaxy Z Fold3(Expected)
Structure				

Source: UBI Research DB, news.samsungdisplay.com, Visionox

# 3. Development of Components and Materials for Foldable Devices and Industry Status

## 3.2 Analysis of OLED Structure for Foldable Devices

### Foldable OLED for Galaxy Z Fold3

- The structure of the 'Galaxy Z Fold 3' to be released by Samsung Electronics was expected.
- A PET protective film is attached to the top and bottom of the cover window, which will be supplied by \*\*\* \*\*'s high heat-resistant PET will be used for the lower protective film of the substrate.
- As for the cover window, the same 30 um thick ultra thin glass (UTG) will be used like the previous 'Galaxy Z Fold2'.
- A color filter will be applied to the Galaxy Z Fold3 instead of a polarizer. Initially, it was expected that a low reflection film of \*\*\* would be used, but due to the thickness issue, it will not be applied to final mass production.
- The Galaxy Z Fold 3 will be equipped with an electromagnetic resonance (EMR) type pen that requires a digitizer, and two sheets will be placed on the left and right.
- The metal SUS used in the Galaxy Z Fold 2 will be replaced with carbon material due to signal interference between the digitizer and the panel, and \*\*\* carbon fiber reinforced plastic will be processed by \*\*\* and supplied to Samsung Display.

Foldable OLED for 'Galaxy Z Fold3'

Picture	Layer	Thickness	Supplier
Anti finger	Anti finger		SG Hitech
Hard coating	Hard coating		
Protection film	PET		
PSA	PSA		
Ultra thin glass	UTG		
PSA	PSA		
Protection film	PET		
PSA	PSA		
OLED + on-cell touch + color filter	Flexible OLED + Y-OCTA + CF		
PSA	PSA		
Back film	PET		
PSA	PSA		
CFRP + Digitizer	Carbon fiber reinforce plastic		
PSA	PSA		
Digitizer	Digitizer		
Cushion	Cushion		

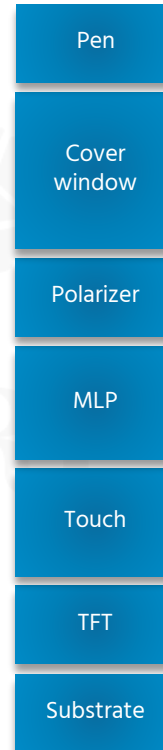
Source: UBI Research DB

# 3. Development of Components and Materials for Foldable Devices and Industry Status

## 3.3 Foldable OLED Business and Exhibition Trends by Panel Maker

### ■ Samsung Display

- Pol-less
  - Black pixel define layer (PDL), color filter, and anti-reflection film are applied.
  -
- UPC
  - A colored PI substrate is used, and it seems that the cathode electrode will be selectively removed with a laser process.
  -
- MLP
  -



Expected change of OLED of Samsung Display for foldable phone

- **Colorless PI**  
(Galaxy Fold)
- **Ultra thin glass**  
(30 um, Flip, Fold2)
- **Thin-pol**  
(Coated pol)
- **Y-OCTA**  
(5 masks, punch hole)
- **HOP(hybrid oxide polycrystalline silicon)**  
(LTPS + Oxide TFT, low power consumption)

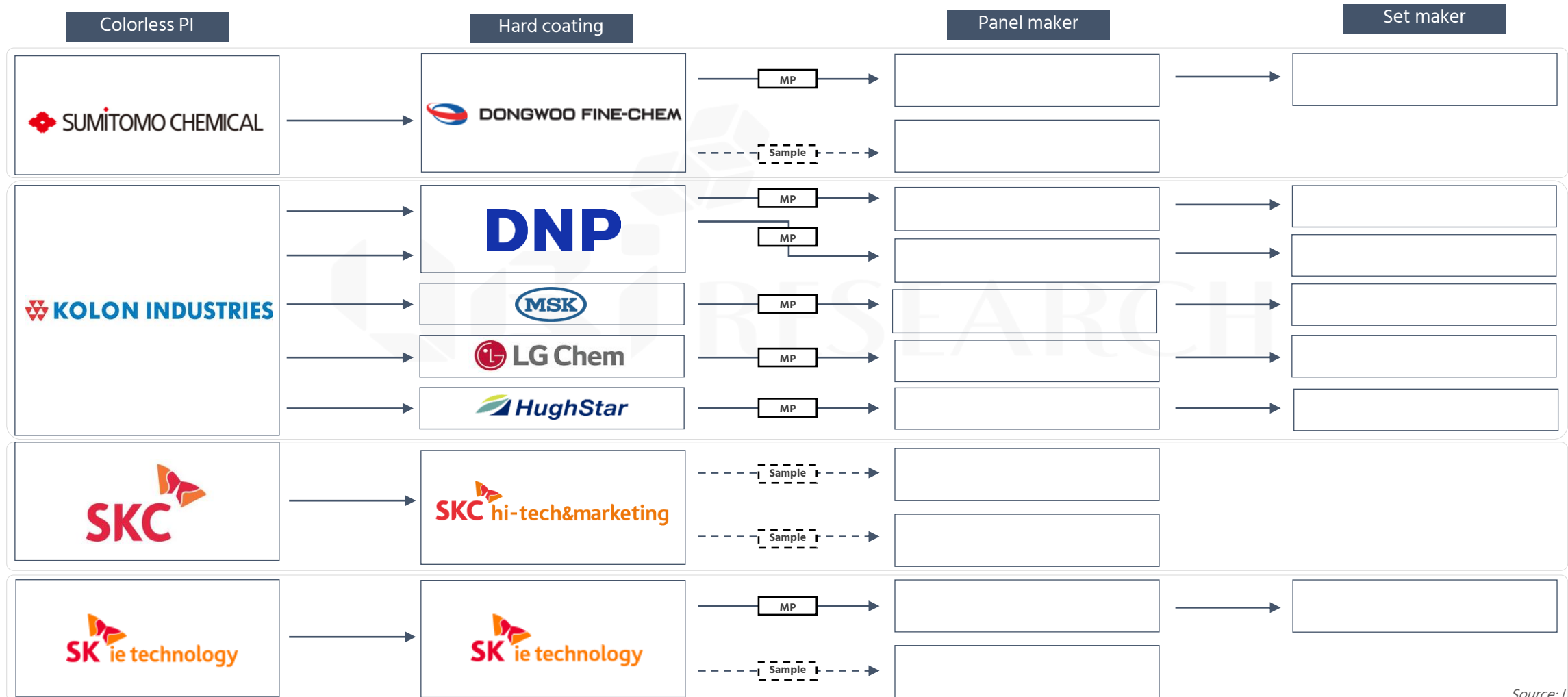
2020 2021 2022 2023

Source: UBI Research DB

# 3. Development of Components and Materials for Foldable Devices and Industry Status

## 3.5 Colorless PI

### Major supply chain



Source: UBI Research DB

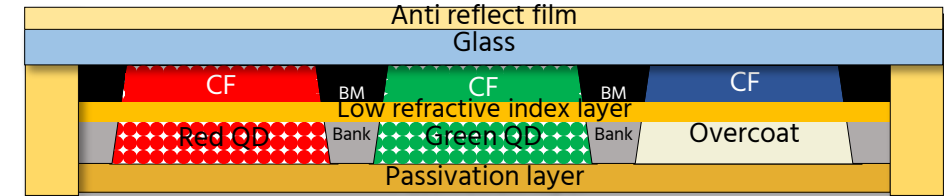
# 4. Components and Materials Development and Industry Status for TV

## 4.1 QD-OLED

### Supply chain forecast

- It seems that [redacted] will supply the anti-reflection film on the substrate to will process this film and supply it to Samsung Display.
- The color register will be supplied by [redacted], the QD will be supplied by [redacted], and the ink will be supplied by [redacted]
- TiO<sub>2</sub> is expected to be added to the QD layer as a scatterer to increase the light conversion efficiency. Since the phase difference of light scattered by TiO<sub>2</sub> is not maintained, QD-OLED cannot structurally use a polarizer. The scatterers are expected to be supplied by [redacted]
- The low-refractive material between the QD layer and the color filter is expected to be supplied by [redacted]
- Bank material development companies include [redacted] and [redacted], while black matrix can be supplied by [redacted]
- The resin overcoat material is expected to be supplied by [redacted]

Predicted structure of color filter for QD-OLED



Expected supplier of color filter for QD-OLED

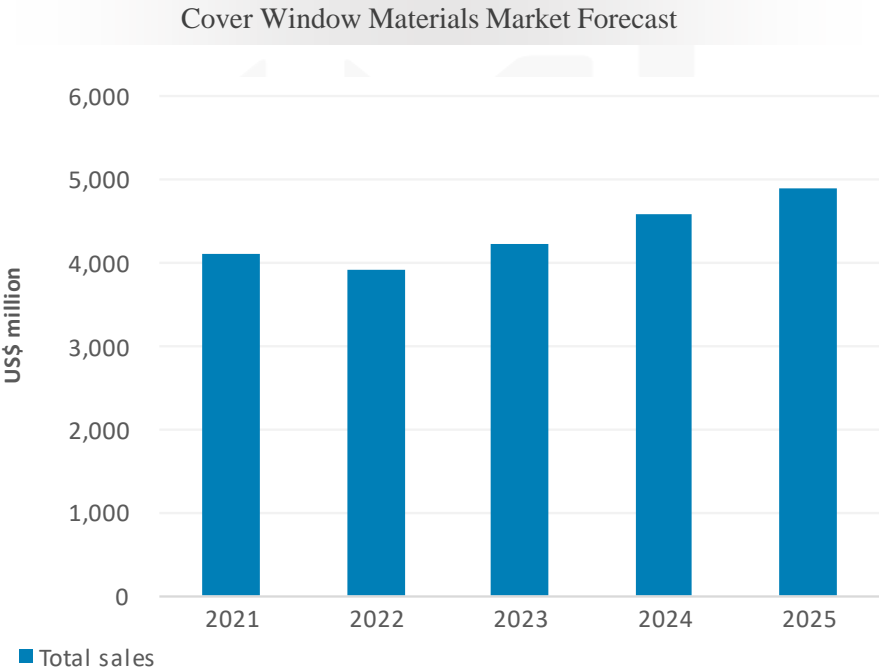
Items	Supplier
Anti reflect film	[redacted]
Color resist(RGB)	[redacted]
Low index refractive layer	[redacted]
Quantum dot(RG)	[redacted]
Ink	[redacted]
TiO <sub>2</sub>	[redacted]
Black matrix	[redacted]
Bank	[redacted]
Overcoat	[redacted]

Source: UBI Research DB

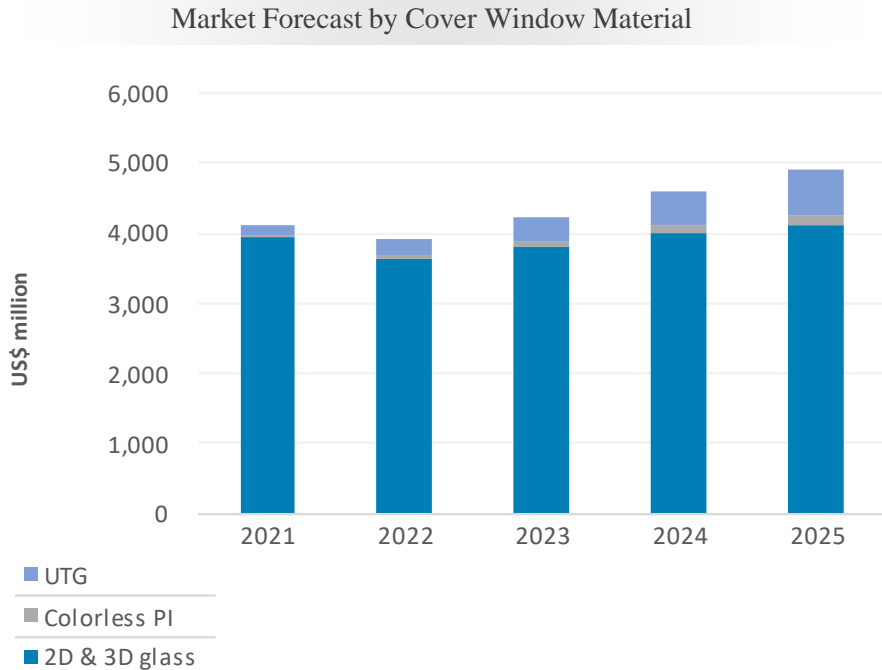
# 7. Major Components and Materials Market Forecast

## 7.9 Cover Window

- Materials for cover windows include 2D glass, 3D glass, colorless PI, and UTG.
- The cover window material market is expected to grow from \$ billion in 2021 to \$ billion in 2025, growing at a CAGR of %.
- By 2025, 2D glass and 3D glass are expected to account for the largest share of the cover window materials market with % of the total, with UTG accounting for % and colorless PI with %.



Source: UBI Research DB



Source: UBI Research DB





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