

# 2021 Flexible & Foldable OLED Report

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# 2. Foldable and Rollable Device Development Trends by Set Makers

## 2.2 Structural Analysis of OLED for Foldable Devices

### Foldable OLED for Galaxy Z Fold3

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

Foldable OLED for Galaxy Z Fold3

Picture	Layer	Thickness	Supplier
Anti finger	Protection film		
Hard coating			
Protection film			
PSA			
Ultra thin glass	Cover window		
PSA			
Protection film	Protection film		
PSA			
OLED + on-cell touch + color filter	OLED panel		
PSA	Back film		
Back film			
PSA			
PSA	CFRP		
CFRP + Digitizer			
PSA	Digitizer		
Cushion			
	Cushion		

Source: UBI Research DB

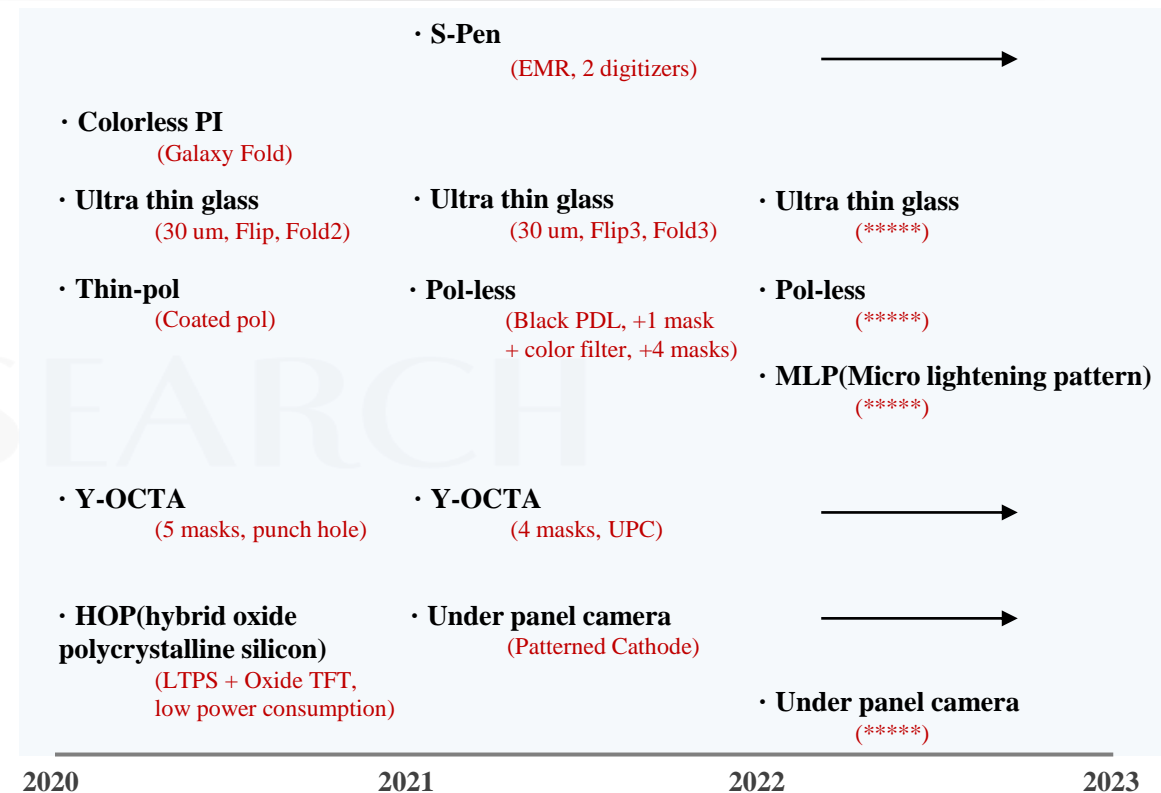
# 3. Foldable and Rollable Device Development Trends by Panel Maker

## 3.1 Samsung Display

- Pol-less
  - Black pixel define layer (PDL), color filter, and anti-reflection film are applied.
  - A spacer made of PSPI material is located on the upper part of the black PDL, and each photo process is performed once. In the future, it is expected that the black PDL will also play the role of a spacer and the photo process will be carried out only once through the halftone process.
- UPC
  - A colored PI substrate is used, and it seems that the cathode electrode will be selectively removed with a laser process.
  - Transparent PI substrates are also being developed, and the expected application time is 2022-2023, but mass production may be difficult due to the process temperature.
- MLP
  - It is expected to be applied to the 2022 foldable model in a different way from the existing 'Galaxy S21 Ultra'.



Samsung Display expected to change OLED for foldable phones in the future



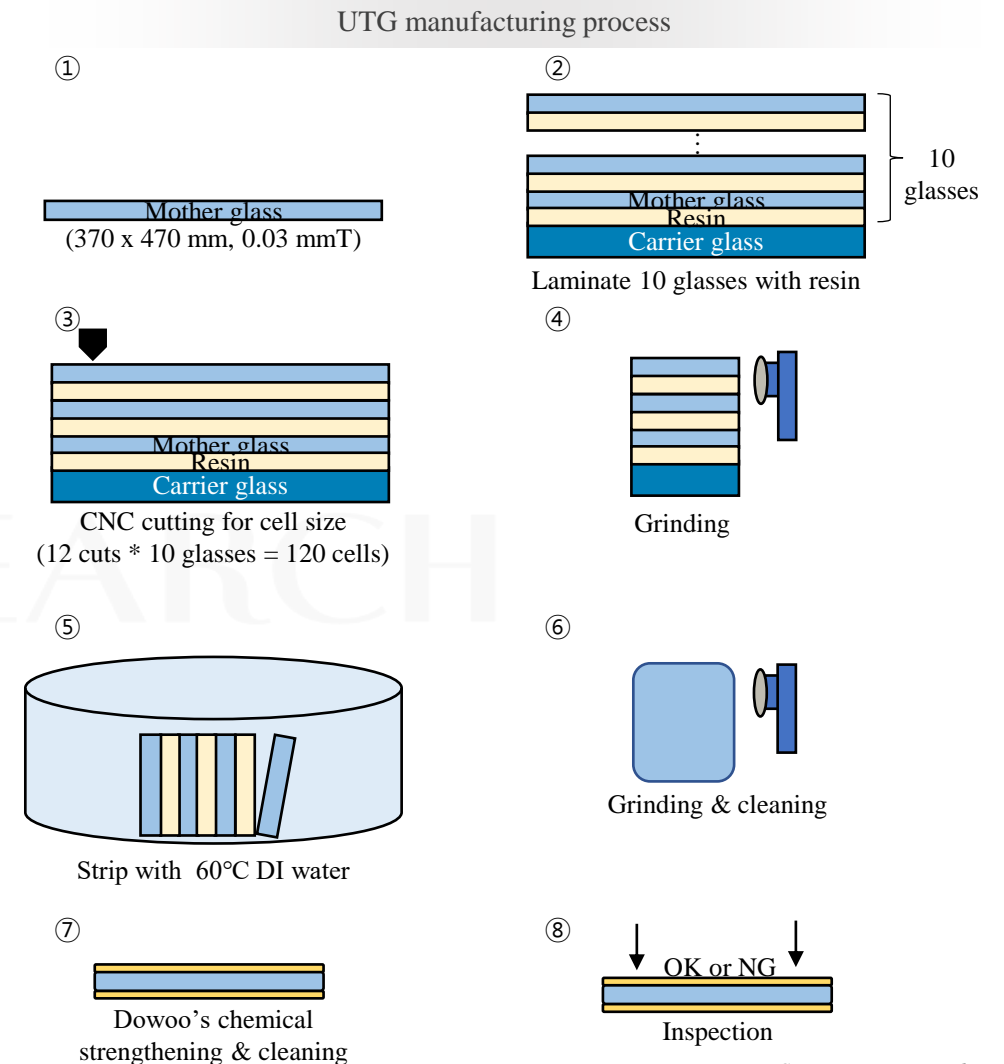
Source: UBI Research DB

# 4. Material and Technology Trends Related to Foldable and Rollable OLED

## 4.1 Ultra Thin Glass

### ■ Dowoo Insys

- Dowoo Insys is a representative company that has UTG's damage prevention reinforcement processing technology.
- Dowoo Insys receives 30um thick UTG from \*\*\*, processes it and supplies it to \*\*\*.
- Dowoo Insys has three UTG reinforcement lines, and the capa is as follows.
  - Units 1 and 2: This is a mixed production line for UTG for Flip and Fold. When mass-producing UTG for Flip, the capacity of one line is \*\*\*/month, and when mass-producing for Fold, the capacity is \*\*\*/month.
  - Unit 3: This is a dedicated line for the 7-inch range. Capa is \*\*\*/month.
  - Overall: Based on the fold, the total capacity of the three lines is \*\*\*/month, and the yield is \*\*%.
  - One line is scheduled to be added in the first half of 2022, and the capacity for folding is \*\*\*/month.
- \*\* 6.7-inch panels and \*\* 7.6-inch panels can be produced from UTG mother glass of 370 x 470 mm.

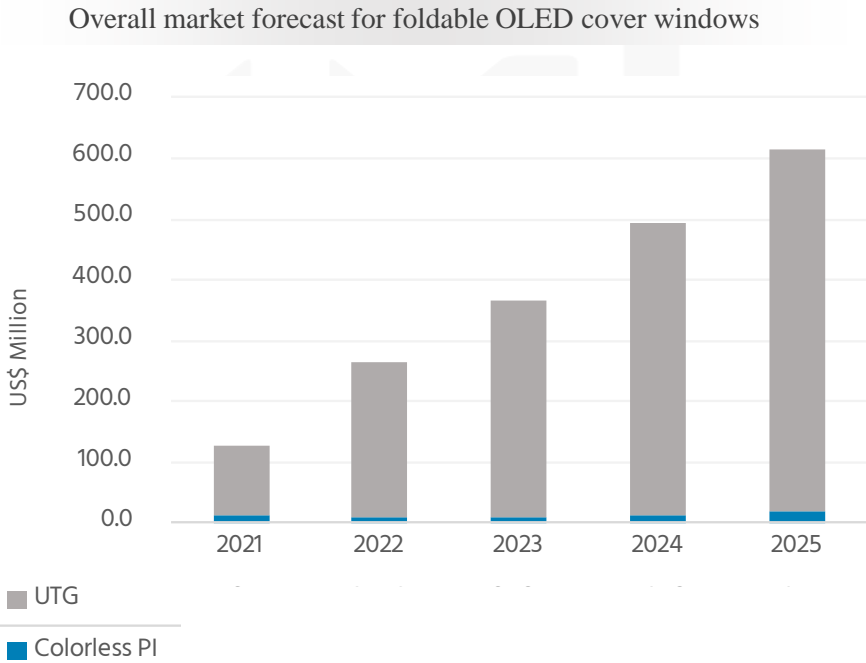


Source: UBI Research DB

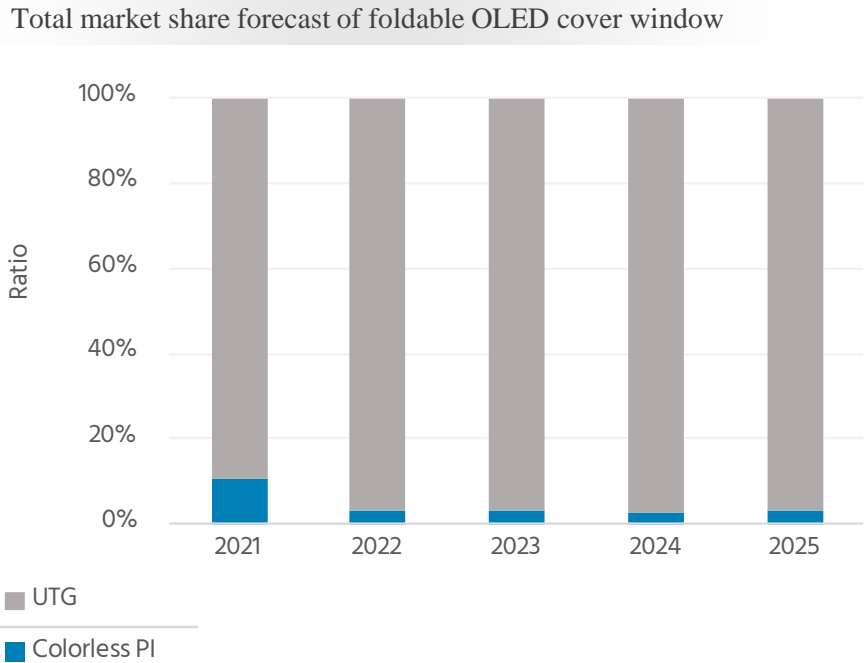
# 5. Market Forecast of Cover Windows for Foldable Phones

## 5.1 Total

- We forecast the cover window market for foldable phones and exclude other application products such as tablet PCs.
- The overall market for cover windows for foldable phones is expected to form a market of \$\*\*\* million dollars in 2021 and a market of \$\*\*\* million in 2025.
- In 2021, UTG cover windows are expected to generate a market of \$\*\*\* million, and colorless PI cover windows are expected to create a market of \$\*\*million.
- UTG cover windows are projected to account for more than 95% of the market share from 2021 to 2025.



Source: UBI Research DB



Source: UBI Research DB

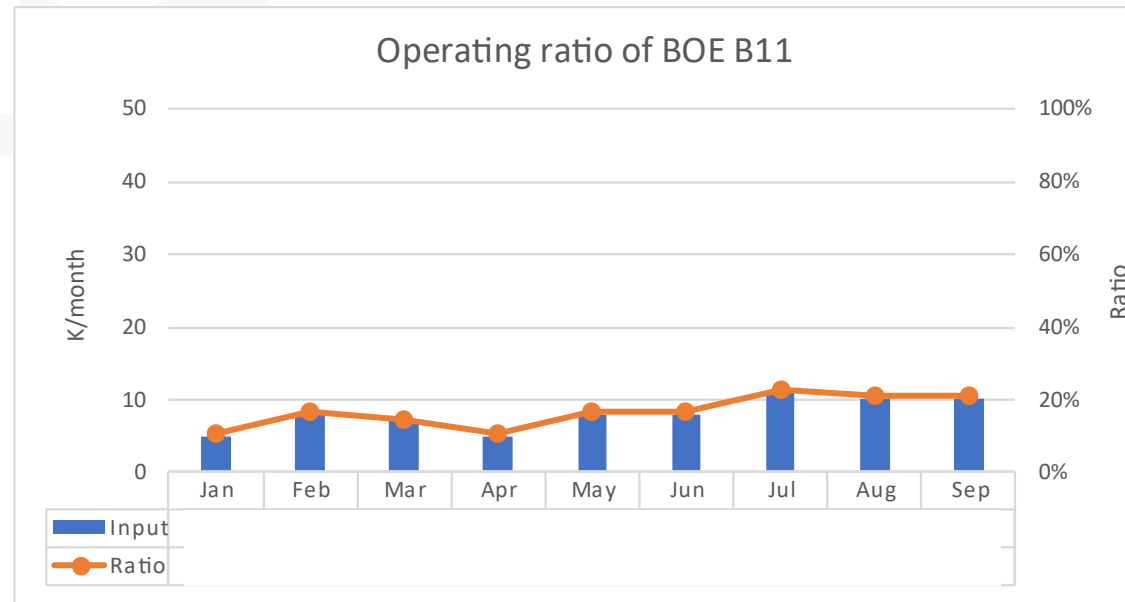
# 6. Panel makers' Flexible OLED Line Trends and Capa Prospects

## 6.2 Line Trend Analysis of Chinese Panel Makers

### BOE

#### [B11 Mianyang (Gen6)]

- There are 14 Apple-exclusive module lines, and investment in 5 additional lines has been confirmed. Equipment for the additional five lines will all be brought in in the first half of 2022. 1 line added for B12 module review, totaling 20 module lines in B11.
- The LTPO TFT line expansion was completed in the first half of the year, and the development speed was faster than that of the B7. It plans to supply samples for LTPO TFT verification to Apple in the fourth quarter of 2021.
- Apple's iPhone 13 was certified in October and plans to mass-produce panels from the end of October.



Source: UBI Research DB

# 7. Flexible OLED Market Forecast

## 7.5 By Company and by Application

Flexible OLED market forecast by company and application

(Million unit)

Company	Application	2021	2022	2023	2024	2025
BOE	Smart phone					
	Watch					
	Foldable phone					
TCL CSOT	Smart phone					
	Foldable phone					
JDI	Watch					
JOLED	Monitor					
LG Display	Smart phone					
	Watch					
	Automotive					
Samsung Display	Smart phone					
	Watch					
	Foldable phone					
Tianma	Smart phone					
Visionox	Smart phone					
	Watch					

Source: UBI Research DB



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