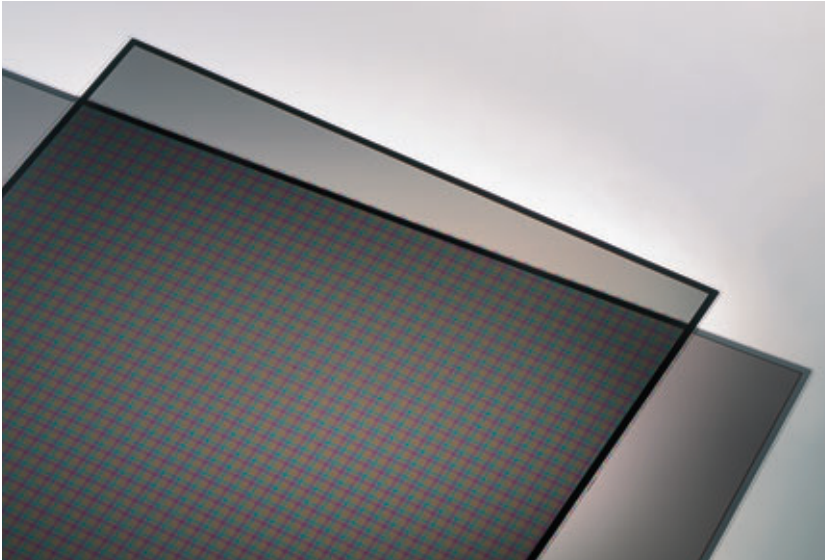


Color Filters for LCDs

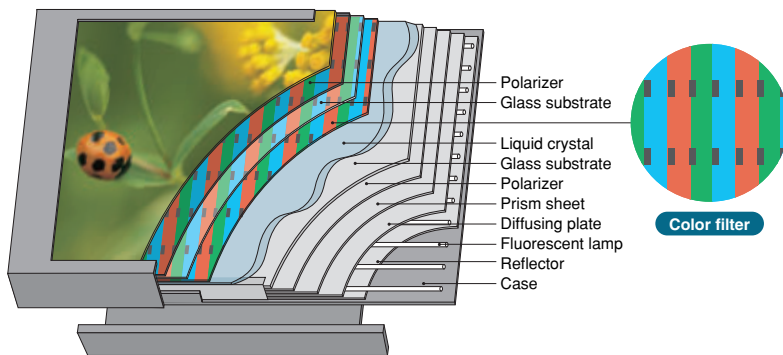


Broad application to products from LCD TVs to cellular phones

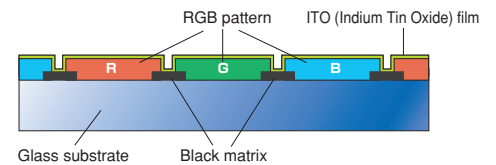
One of the most important parts to influence the quality of images on color liquid crystal displays is the color filter. Toppan, utilizing superfine fabrication technologies based on photolithographic technologies for printing, first developed a color-striped filter for the image pickup tube of video cameras in 1971. Since then, Toppan has vigorously promoted the research and development of color filters. As a result, Toppan, as the top manufacturer in this line of products, is now greatly contributing to the expansion of the LCD market with its expertise. We at Toppan Printing supply color filters of excellent quality for various applications ranging from large size LCD TVs to cellular phones.

Basic structure of color LCD panel

A liquid crystal panel has a structure sandwiching liquid crystals between two pieces of thin glass substrate. Light emitted from backlight lamps (fluorescent lamps or others) is controlled by this liquid crystal and two polarizer sheets. The color filter is formed on one of the glass substrates, enabling color display on an LCD panel.



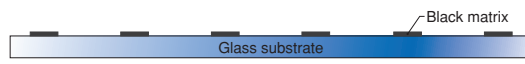
Structure of color filter



According to the basic structure of the color filter, a primary three-color pattern of RGB (red, green and blue) is formed over a black matrix. Upon this, an ITO film (transparent conductive film), which becomes the common electrode for a TFT array substrate, is formed.

Color filter manufacturing process by the photolithographic method

1 Black matrix formation
(low reflectance chrome or resin)



A black matrix is formed first in order to prevent any leakage of backlight and the RGB color mixture.

2 Color resist coating



Color resist is coated on the entire glass substrate surface.

3 Exposure



To make the pattern insoluble, it is UV cured by exposure through a photomask.

4 Development & baking



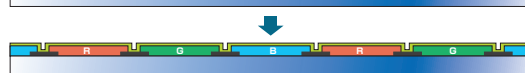
After the removal of unnecessary portions of the color resist by the developing solution, the pattern is cured through baking.

2-4 Repeat of 2 to 4



The above processes from 2 to 4 are repeated three times (for RGB).

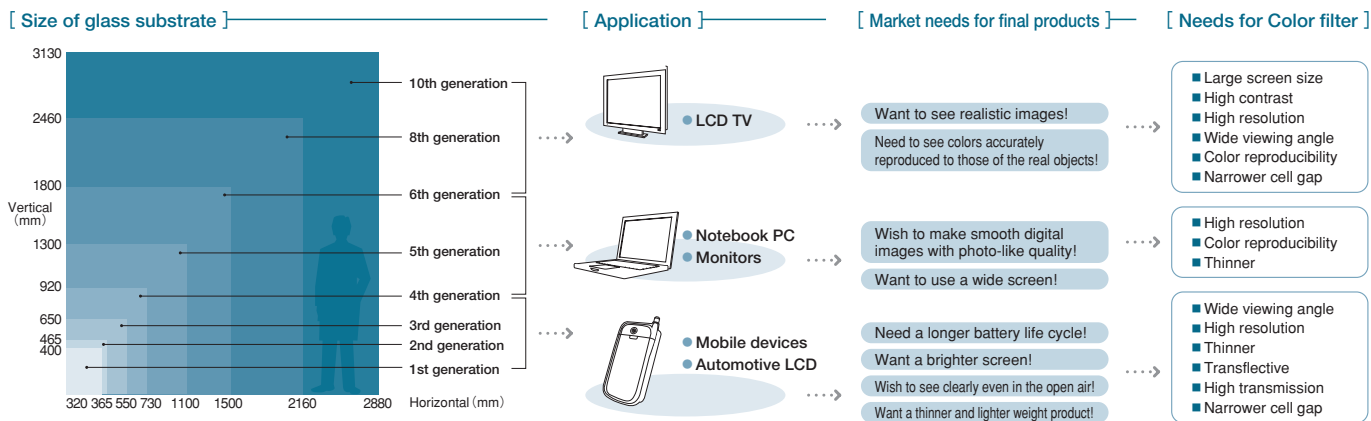
5 ITO film formation



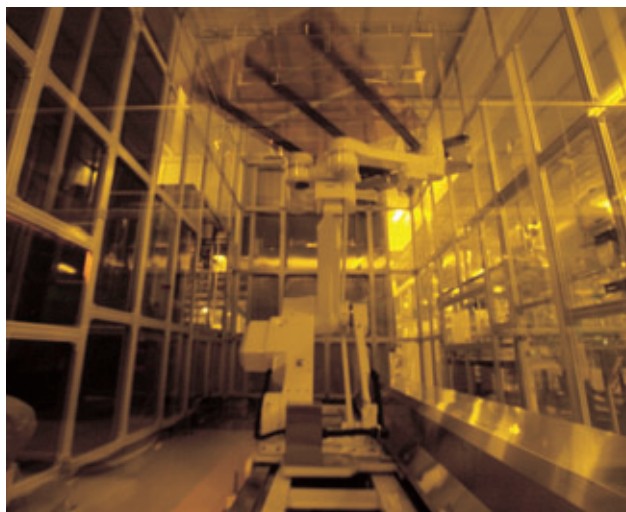
ITO film (transparent conductive film) is formed by the sputtering method.

Color filters corresponding to needs

There are various types of LCDs for different applications and sizes in the market, thus the properties required for color filters are also quite diversified. In order to provide the best-suited color filters to fulfill the needs of the market, Toppan has been endeavoring to achieve continuous improvement day by day.

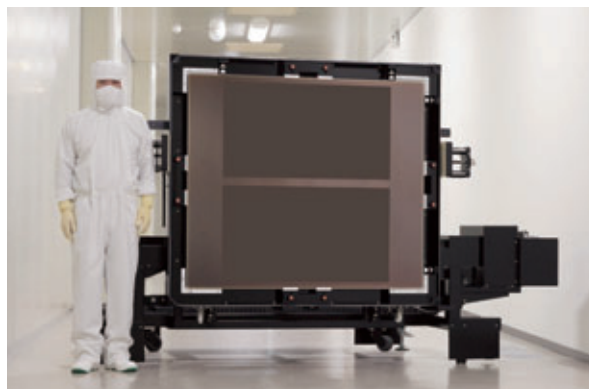
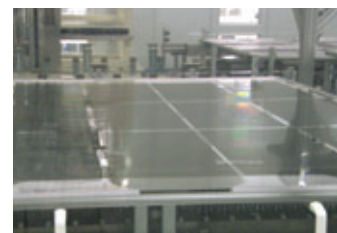


Manufacturing environment



Along with an increase in the glass substrate size, sizes of all manufacturing equipment such as the coater, exposure machine, transferring robot, etc. need to become larger as well. Even for extraordinary large sized substrates, Toppan is manufacturing high quality and high precision products on a daily basis, regardless of size, thanks to its high level technologies and know-how that have been accumulated over long periods of time.

The fabrication is made on large glass substrates of several squaremeters in area and a thickness of only one millimeter or less within only a few micrometers' tolerance. Because of the extreme precision, the manufacturing environment in clean rooms is strictly controlled.



[Photomasks for LCDs] —Masks for manufacture of color filters—

The most crucial part for formation of patterns on color filters is the photomask for LCDs. Along with the recent trend of larger sized liquid crystal displays, photomasks for LCDs are also required to achieve larger size and higher precision. By fully utilizing its superfine micro fabrication technologies, Toppan is manufacturing and selling the most reliable and highest precision photomasks for LCDs, just as it does for semiconductors.

※ See Page 3 about the manufacturing process of photomasks.