AMOLED Technology for Mobile Displays

Ho Kyoon Chung
Samsung SDI Corporate R&D Center

Display market can be divided into two major categories; one category is for mid to small mobile displays and the other is for mid to large fixed displays. Due to the nature of mobility, mobile displays have different priority in requirements compared with fixed displays such as monitors and TV's. Three high priority requirements are 1) thin & light, 2) low power, and 3) high resolution. AMOLED has an apparent advantage over TFT LCD's in thickness and weight since there are no need for backlight and color filter. However, meeting the requirements for low power consumption and high resolution in AMOLED have been challenging, because the market demand continues to change to higher performance such as lower power with higher brightness and higher resolution.

The power consumption of AMOLED depends largely on the efficiency and color index of light emitting materials. Based on the recent advances in material characteristics, we can predict that phosphorescent materials in red and green result in 30~40 % power savings compared with fluorescent materials case. Also, the PIN structure gives rise to the lower power by lowering the operating voltage of the OLED.

Realizing high resolution in AMOLED beyond 200 ppi level has been deemed very difficult. The Fine Metal Mask (FMM) approach, which is currently the only one available for manufacturing full color OLED, has a limitation in resolution due to mask alignment accuracy and dimensional variation. Ink jet printing can be used for full color patterning but the materials that are soluable and printable do not meet the demand of the full color mobile displays yet. By using a unique color patterning method, called Laser Induced Thermal Imaging (LITI), we have successfully demonstrated the feasibility of realizing 2.65" VGA AMOLED with resolution of 302 ppi. A unique pixel circuit for compensating the threshold voltage variation in poly-Si TFT has also been developed. The total integration of such high resolution AMOLED displays was realized by using 2 micron design rule in LTPS process and top emission structures.

In summary, key issues in AMOLED technology for mobile displays are reviewed and solutions to resolve these issues are presented. Development of blue phosphorescent materials and high resolution color patterning using LITI will meet the challenge of next generation AMOLED mobile displays.