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Status and Trends of Femtosecond Laser Processing in AMOLED, Next Generation Displays Manufacturing Industry

Sung-Hak CHO
Head, Department of Laser & Electron Beam Application, KIMM (Korea Institute of Machinery & Materials)
171 Jang-dong, Yuseong-gu, Daejeon 305-343, Korea
Professor, Femto Process Lab. (UST-KIMM, Korea Univ. of Science and Technology), Korea

I report the present status and trend of femtosecond laser processing in AMOLED display manufacturing industry of Korea and world. Also, the current technical issues of ultrafast laser processing in the next generation AMOLED (High-definition, Flexible, Transparent, Large size AMOLED TV) manufacturing industry will be reviewed.

Active-Matrix Organic Light-Emitting Diode (AMOLED) is a new display technology for mobile phones, televisions, and everything in between. Currently used on several top Android Smartphones like the LG Flex, Nexus, and Samsung Galaxy S series, the market for AMOLED displays is expected to reach a level of $28.3 billion by 2020. OLED (Organic Light-Emitting Diode) refers to the thin film of organic material on top of the display. When electrical current is applied to this film, it gives off light, just like a regular LED – except it's only a few nanometers thick. AM (Active Matrix) refers to the display is addressed. Each pixel has an active element (a thin-film transistor, or TFT) that actively provides current to the OLED, maintaining that pixel's brightness while the other pixels are being addressed. Without the active matrix, OLED displays are small and low-resolution, used for applications like mobile phone sub-displays. AMOLED displays are a next-generation technology; they have both higher performance, and lower potential cost than AMLCDs. AMLCD has the problem with most of the backlight`s light in the LCD layers. The backlight must be on even during dim images, wasting a lot of power. And the liquid crystal layer can't block all the light, so some light leaks through, making the blacks "gray". Also, because the light comes from the backlight, and has to pass through several layers, the viewing angle can be poor. On the other hand, AMOLEDs have advantage with lower power. Only those pixels that are lit up consume power; dim screens (such as white text on a black background) consume almost no power, and video (where the pixels are only about 30% on) consumes much less power than LCD. Moreover, they have higher contrast, better viewing angle, and richer colors. When a pixel is off, no light comes out all. This high contrast (over 100,000:1) gives stunning image quality. And because the light comes from the OLEDs on top of the display, the viewing angle is a true 180 degrees with no color shift. In addition, the colors of the OLEDs are rich and deep, so the display looks much more vibrant than LCD.