Thermal transfer pixel patterning method by general lamp source in organic light emitting devices

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Organic light emitting devices (OLED) is the most promising technology for both the large area TV and the mobile display applications. However one of critical issues in the OLED is pixel formation process. Currently used fine metal mask (FMM) process has limitations to fabricate high resolution and large-size displays. As alternative technologies, LITI (laser induced thermal imaging), LIPS (laser induced pattern-wise sublimation), and ink-jet printing were reported with strong technical possibilities for the future process. However these methods still have various process issues such as low yield, non-uniformity, low device stability, and etc.

In this paper, we report a new thermal transfer method based on general light source. Firstly we designed and fabricated several donor substrates for our thermal transfer process. We also designed and fabricated a vacuum chamber with general lamp source for the investigation of this process (see Figure 1(a)). The donor substrate and glass substrate are placed in the chamber. Organic layer is transferred from donor to glass substrate by lamp heating. Donor substrates consist of three layers; an light absorption layer which convert light to heat energy, patterned layer to transfer the organic layer selectively and a protection layer to prevent the diffusion of absorption layer by heat. Figure 1(b) shows the principle of organic layer patterning. The organic material on the donor substrate is locally heated and evaporated by the patterned layer. From this process, we obtained emissive layer patterns under 100 μm size as depicted in Figure 2(a). To verify this process, we fabricated red phosphorescent OLED devices. Device performances are compared with those of thermal deposition processed control device. The driving voltage increase at 1,000 cd/m^2 is 0.7 V and the maximum current efficiency decreases about 8 cd/A due to the environmental oxygen contamination.

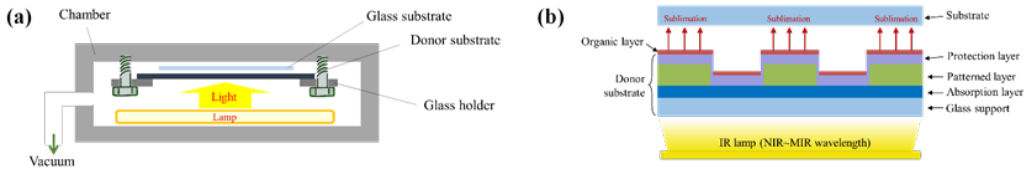

Fig. 1. (a) Schematic diagram of thermal transfer chamber, (b) Principle of thermal patterning process

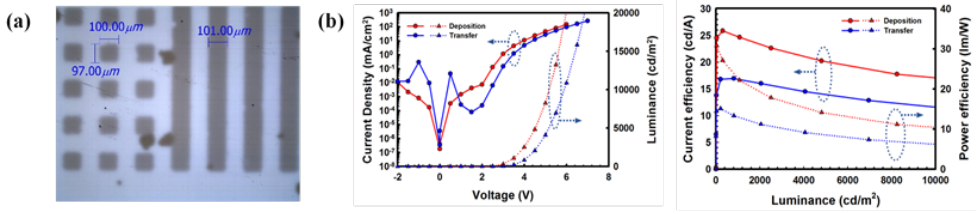

Fig. 2. (a) 100 μm size pattern formation, (b) Performances of transferred and control OLEDs

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