High-efficiency white phosphorescent polymer light-emitting devices

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Polymer light-emitting devices (PLEDs) are promising for application to large-area and fine-pixel displays because polymer film can be prepared by wet processes. We have demonstrated the PLED emitting white phosphorescence, which has potential to realize full-color displays simply by using color filters. Blue phosphorescent polymer (BPP) and red phosphorescent polymer (RPP) were used for the emissive layer, and the emission color was tuned by controlling the concentration ratio of BPP to RPP. The external quantum efficiency of the device, with CIE coordinates of (0.34, 0.36), was 6.0% at luminance of 100 cd/m^2, which is as high as the highest values reported for white-emitting organic light-emitting devices (OLEDs) based on small molecules. To investigate the emission mechanism in the PLED, its photoluminescence spectrum and transient decay were measured. These experimental measurements indicate that direct excitation of the iridium-complex (Ir-complex) units by carrier trapping is a major excitation process. In addition, a 3.6-inch full-color display based on the white phosphorescent PLED and color filters was demonstrated. Although the emission efficiency is generally decreased by color filters, highly efficient white phosphorescence can maintain high emission efficiency to a degree. This method of fabrication may be the simplest way to produce the displays because mask-less and wet processes can be used, resulting in low-cost and easy fabrication.

High-performance ultra-small single crystalline silicon microphone of an integrated structure

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This paper describes a new type of microphone using unique semiconductor microfabrication technology, aiming for a next-generation ultra-small high-performance microphone.

We have succeeded in fabricating an ultra-small condenser microphone that has excellent acoustic characteristics, excellent reliability and mass-producibility, with an integrated structure made from single-crystalline silicon, a material that has high tensile strength. This is owing to the use of bonded wafer, which is prepared using powder silicon oxide as a glue (SODIC; Soot Deposited Integrated Circuit method), and precise control of the thickness of diaphragm, which is a thin film that vibrates under acoustic pressure.

The experimental prototype microphone with a diagram thickness of 5 μm and an air gap length of approximately 15 μm operating with a bias voltage of 48 V was fabricated and tested. The prototype's acoustic characteristics are: wide dynamic range with excellent linearity up to 10 Pa, wide frequency range of 75 Hz - 24 kHz, and high sensitivity of -47 dB (0 dB=1 V/Pa). Since it is made of single-crystalline silicon, it is robust and thermal resistant. Moreover, it has suitability for mass production, because it is fabricated with a semiconductor microfabrication process.

256×192 pixel field emitter array image sensor with high-gain avalanche amorphous photoconductor target

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We have been studying a new type of flat image sensor consisting of an FEA (field emitter array) and a highly sensitive HARP (high-gain avalanche rushing amorphous photoconductor) target, with the aim of developing next-generation compact TV cameras having both ultra-high sensitivity and high-definition features. A 256×192 pixel prototype FEA image sensor of which the pixel size (90 μm×90 μm) is smaller than that (180 μm×180 μm) of the previous sensor was fabricated and tested as a step towards the development of practical image sensors.

The amplitude response of the prototype sensor was about 10% at the Nyquist spatial frequency (about 5.6 lp/mm, stripe width of 90 μm), and it was about 90% at the spatial frequency of 2.8 lp/mm (stripe width of 180 μm). This result agrees with the simulation result that the spot size of the scanning electrons for the readout of the signal charges on the HARP target is estimated to be about 170 μm. The prototype also had a wide dynamic range, high sensitivity, and low power consumption, which indicates its potential as a next-generation image sensor.