OLED-on-silicon for near-to-eye microdisplays and sensing

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1. Introduction

Smart eyewear featuring near-to-eye (NTE) displays have evolved as major devices for wearable displays, which hold potential to become adopted by consumers soon. Tiny OLED-on-silicon microdisplays (<1" screen diagonal) are a key component of eyewear displays, creating images from active-matrix organic light emitting diodes (AM-OLED), similar to those that have become popular in mobile phone displays.

2. OLED-on-Silicon technology

All microdisplay technologies on the market comprise an image-creating pixel modulation, but only the emissive ones (for example, OLED and LED) feature the image and light source in a single device, and therefore do not require an external light source. This minimizes system size and power consumption, while providing exceptional contrast and color space. These advantages make OLED microdisplays a perfect fit for near-eye applications. Low-power active-matrix circuitry CMOS backplane architecture, embedded sensors, emission spectra outside the visible and high-resolution sub-pixel micro-patterning address some of the application challenges (e.g., long battery life, sun-iight readability, user-interaction modes) and enable advanced features for OLED microdisplays in near-to-eye displays, e.g., in upcoming augmented-reality (AR) smart glasses as well as significantly improved virtual-reality (VR) headsets.

Figure 1: Near-to-eye information display use case (left), new 0.64" 720p OLED microdisplay (right)

3. New 0.64" 720p OLED microdisplay

A new 0.64" 720p OLED microdisplay for application in industrial AR see-through head-mounted displays (ST-HMD) has been developed. It features 1280x720 resolution at a pixel pitch of 11um with four sub-pixels, 8bit/color and parallel interface. For low-latency AR an adequate high frame rate has been targeted. To reduce effects of motion blur a "rolling emit" feature has been implemented next to "global emit".

4. Embedded sensing

Beyond microdisplays for near-to-eye, OLED-on-silicon can be favourably used in optical sensing, e.g., as miniaturized phosphorescence sensor. In this sensor, a chemical marker is excited by modulated blue OLED light. The phosphorescent response of the marker is then detected directly inside the sensor chip. The marker determines the substance to be measured; a typical application is measurement of an oxygen concentration.

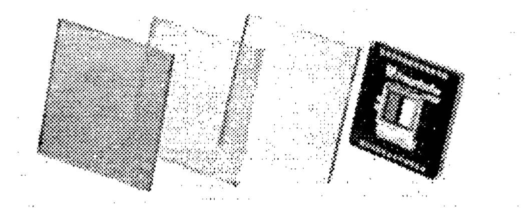

Figure 2: 0.4" OLED-on-Silicon Sensor

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6. References

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