PRESS RELEASE

High-Voltage CMOS Backplane for Very Bright OLED Microdisplays

A common method to increase the brightness of OLEDs while maintaining a long lifespan is the use of multiple stacked OLEDs. Scientists at the Fraunhofer Institute for Photonic Microsystems IPMS have now developed an innovative high-voltage CMOS backplane that enables exceptionally bright microdisplays. These will be presented for the first time at the SID Display Week 2025, from May 13 to 15, 2025, in San José, USA (Booth No. 1135 at the German Pavilion).

Numerous applications benefit from the image quality and high brightness of OLED microdisplays. These displays are used in augmented reality (AR) glasses for vibrant and clearly visible content under varying lighting conditions, or in virtual reality (VR) headsets for realistic and bright images. They are also utilized in military applications for clear visibility of commands and situational indicators in military devices under extreme conditions.

OLEDs are considered limited at very high brightness in harsh environments. Therefore, microLEDs are often promoted as an alternative, claiming brightness (luminance) levels even in the range of one million cd/m². However, microLEDs experience a significant efficiency loss at very high pixel densities, which are required in high-resolution microdisplays. This means they must be operated with more than 1A/cm². Furthermore, this technology is still not mature, especially for full color. In contrast, the current density for OLEDs during long-lifespan operation is typically below 100 mA/cm².

However, these limitations can be significantly improved by stacking OLED layers on top of each other. The current density of individual OLED layers is limited to ensure adequate lifespan and reliability. However, stacking OLED layers increases the voltage drop and swing across the OLED stack. A high-voltage CMOS backplane for high-brightness OLED microdisplays has now been developed.

Dr. Uwe Vogel, head of "Microdisplays and Sensors" at Fraunhofer IPMS, explains: “We have developed an innovative pixel cell design that allows for a voltage swing of over 10 volts, enabling the operation of multiple stacked, top-emitting OLED layers. Depending on the number of stacked units, multiples of the maximum emission can be achieved with high current efficiency while maintaining constant current density. This approach enables full color maximum brightness of over 10,000 cd/m² while maintaining lifespan and reliability.”

Editor
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The advantages of OLEDs over microLEDs are evident:

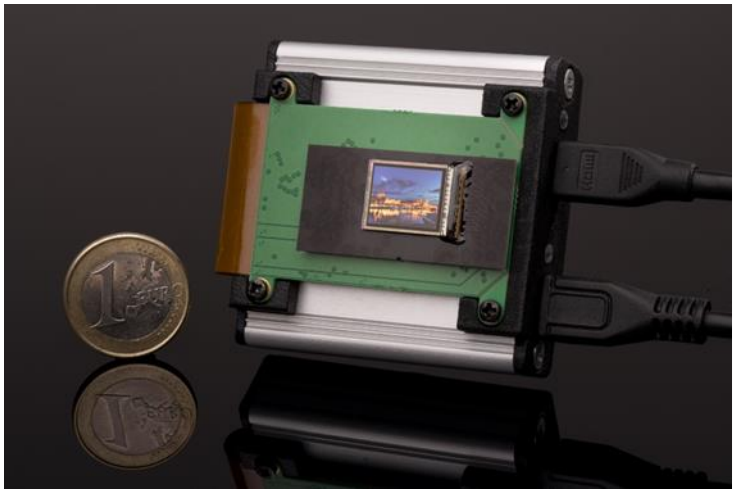
1. **Maturity:** OLED technology has reached a high level of maturity and there are already many established products on the market. MicroLEDs are not yet as advanced, especially for the display of full color.
2. **Current Density**: In typical operation, OLEDs can be operated with a current density of <100 mA/cm², which gives them higher efficiency and a longer service life. MicroLEDs, on the other hand, often require over 1A/cm², which leads to a significant loss of efficiency.
3. **Brightness:** The ability to stack several OLED layers on top of each other means that the brightness can be increased to more than 10,000 cd/m². This improves the application possibilities in bright environments.

In summary, OLEDs are advantageous due to their maturity, efficiency, and color representation in many applications, while microLEDs still require technological advancements to offer similar benefits.

By applying multiple stacked OLEDs on a high-voltage CMOS backplane, this brightness can now be extended to about 10,000 cd/m², significantly increasing market opportunities for very bright OLED microdisplays.

Fraunhofer IPMS has been developing backplanes for various technologies and especially microdisplays for many years. The institute has developed unique expertise in the entire process chain, from feasibility studies to pilot production (in OLED microdisplays). The scientists are excited to bring the new backplane technology to market in collaboration with industry partners.

Image Material



0.62-Inch SXGA High-Voltage CMOS Backplane with OLED

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Fraunhofer IPMS at SID Display Week:

Exhibition stand: No. 1135, German Pavilion

Presentations:

Session 100: AR/VR Fabrication and Testing

100.5 (INVITED): Dr. Uwe Vogel "High-Voltage CMOS Backplanes for High-Brightness OLED Microdisplays",
Friday, May 16, 2025, 14:50 - 15:10, Room 220C

About Fraunhofer IPMS
The Fraunhofer IPMS is an internationally leading research and development service provider for electronic and photonic microsystems in the application fields of intelligent industrial solutions, medical technology and health, mobility, and green and sustainable microelectronics. The institute works on electronic, mechanical, and optical components and their integration into miniaturized devices and systems. The offering ranges from conception through product development to pilot manufacturing in its own laboratories and cleanrooms.