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Microdisplays for transfer to the Saxon industry

Within the project "Backplane", funded by the Saxon State Ministry of Economics, Labor and Transport SMWA and the European Union (grant number: 100392259), a multicolor OLED microdisplay was realized by scientists of the Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP. With the Saxon project partner digades GmbH, a finished optics module should be brought to market in the future.

Motorcyclists must look down to read navigation data or speeds from the handlebars or speedometer. These are moments when attention is distracted from the road or terrain. Helmets with integrated displays in the field of view can provide more safety for this and also display useful information under poor visibility conditions.

In cooperation with GLOBALFOUNDRIES Dresden, Module One LLC & Co. KG and digades GmbH, Fraunhofer FEP was researching on a solution for energy-saving and high-resolution OLED microdisplays within the project "Backplane". Such small displays are efficient devices for displaying navigation data in, for example, motorcycle, ski, or bicycle helmets. They can also provide support in a medical context.

However, the information from the display must be mirrored into the viewer's eye using suitable optics. The company digades GmbH, an experienced system integrator for electronics, contributed its expertise in the development of head-up displays for helmets to the project. Under the brand name TILSBERK, the company already sells monochrome navigation displays that can be installed in motorcycle helmets as retrofit head-up displays. Multicolor displays that are also even more energy-efficient than the current solution would be optimal for this application.

Dr. Uwe Vogel, deputy director of Fraunhofer FEP, is excited: "Within the funded research project "Backplane", it was possible to create fundamentals that enable the development of innovative microdisplays. We would now like to use these bases to transfer them into future products in the longer term with Saxon manufacturers."

The project has succeeded in presenting the world's first multicolor OLED microdisplay with the lowest power consumption compared to all available microdisplays. The ability to distinguish between the signal colors red and green is particularly important here.



Diese Maßnahme wird mitfinanziert durch Steuermittel auf der Grundlage des vom Sächsischen Landtag beschlossenen Haushaltes.

Tim Berger, Managing Director of digades GmbH, adds: "The "Backplane" project is a good example of how research and business players can cooperate and of goal-oriented funding in Saxony. Only this has made it possible to create microdisplays that are really interesting for industry and meet their requirements."

The unique architecture of Fraunhofer FEP's ultra-low power OLED microdisplays enables extremely power-saving displays for simple, compact and thus ergonomic systems. With the now multicolor version (with two primary colors) in QVGA resolution (320 × 240 pixels), applications beyond pure displays can be addressed, including navigation displays in motorcycle helmets.

Based on the OLED-on-silicon technology developed earlier, the scientists of Fraunhofer FEP are now in an even better position to support regional, national, and international application partners with optimized and customized developments of CMOS backplane wafers and adapted microdisplay modules and – in cooperation with partners such as digades – up to optical systems with the research results achieved. The application and customer-specific requirements are always in the focus – be it for the evaluation of feasibility or also the upscaling of individual technologies, microdisplay products and systems.

In order to ensure industrial applicability of the technology for the development of the innovative displays, e.g. for future use as an integrated head-up system for various types of helmets, there is still a lot of research to be done: The optical modules must be adapted to the new power-saving microdisplays, and the driving electronics must also be optimized. Subsequent development and qualification are required before the displays can be mass produced. To this end, the partners digades GmbH and Fraunhofer FEP first like to work together on an evaluation kit that future customers can use for initial technology tests.

At Fraunhofer FEP, full-color microdisplays are on the agenda in addition to monochrome and multicolor low-power displays. Here, the feasibility and first implementation steps were demonstrated for the first time in a 28 nm CMOS backplane technology on 300 mm wafers. This made it possible to produce impressive devices with a display diagonal of 0.18 inches, with pixel sizes of just 2.5 microns and resolutions of up to 10,000 dpi. With these results, the researchers at Fraunhofer FEP also want to open up more new application areas and, together with partners such as digades GmbH, take the next steps towards industrial feasibility.

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Already available and in use: The Head-Up Display for motorcycle helmets from "Tilsberk" (a brand of digades GmbH)

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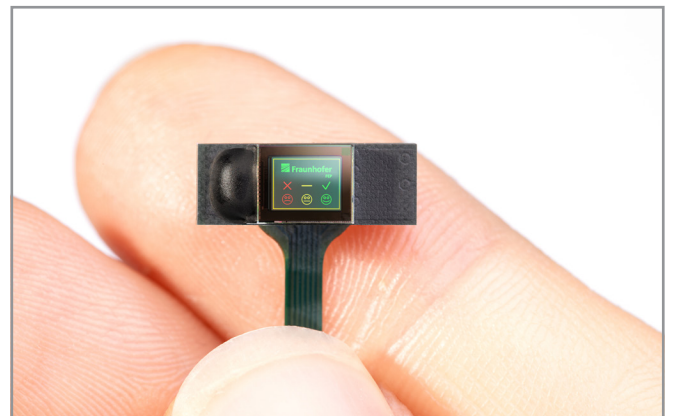
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Head-up module for motorcycle helmets with integrated display and optics

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Multicolored OLED microdisplay with an extremely energy-saving control concept

© Fraunhofer FEP, Photo: Claudia Jacquemin

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About the project "BACKPLANE"

„Deep-submicron CMOS process technology for controlling integrated microdisplays and evaluation circuits of optical sensors“

Funded by: Saxony State Ministry for Economic Affairs, Labor and Transport
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Duration: 12/31/2019 – 10/31/2022

Project Partners:

- GLOBALFOUNDRIES Dresden Module One LLC & Co. KG
- digades GmbH
- Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP

The project partners would like to thank the funding partners for their support, which made the successful implementation of the new ultra-low power microdisplay concepts possible.



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Diese Maßnahme wird mitfinanziert
durch Steuermittel auf der Grundlage des
vom Sächsischen Landtag beschlossenen
Haushaltes.

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The **Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP** works on innovative solutions in the fields of vacuum coating, surface treatment as well as organic semiconductors. The core competencies electron beam technologies, roll-to-roll technology, plasma-activated large-area and precision coating as well as technologies for organic electronics and IC design provide a basis for these activities. Thus, Fraunhofer FEP offers a wide range of possibilities for research, development and pilot production, especially for the processing, sterilization, structuring and refining of surfaces as well as OLED microdisplays, organic and inorganic sensors as well as optical filters. Our aim is to seize the innovation potential of the electron beam, plasma technology and organic electronics for new production processes and devices and to make it available for our customers.