High-performance OLED microdisplays for next-generation smart glasses

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Credit: Uwe Vogel

A consistent trend across the tech sector is the one-upmanship of increasingly high screen resolution and larger display size. Yet, the fact that the former increases faster than the latter means that manufacturers must achieve ever-higher pixel density. Large OLED microdisplays developed under the LOMID project could help solve that problem, thereby providing Europe with a competitive edge.

They are increasingly considered as a must-have for near-eye applications such as virtual reality glasses: within the next few years, OLED microdisplays are likely to play a major part in a market set to be worth USD 1.7 billion in 2027.

To be able to demonstrate their benefits in commercial applications, however, industry will need such microdisplays to be highly flexible, achieve high resolution over large areas and provide acceptably high yields.

The LOMID (Large cost-effective OLED microdisplays and their applications) project, which is coordinated by Dr Uwe Vogel from Fraunhofer FEP, is on track to successfully meeting these expectations. The project's 13 x 21 mm curved microdisplays, boasting a 1 920 x 1 200 (WUXGA) pixel count and exceeding 2 000 ppi have already been manufactured at satisfactory yields, and the consortium is still improving these yields in order to compete in markets where price is as important as performance. The technology is already being demonstrated in smart glasses for both virtual reality and visually-impaired people.

What makes LOMID microdisplays so innovative?

The LOMID displays are larger (1") and of much higher resolution (WUXGA) than anything that has been available on the market until very recently. We have gone to great pains to ensure high contrast and high bandwidth/framerates – the latter is very important for removing motion artefacts and making VR use both immersive and comfortable.

The OLED display of course has high brightness and excellent colour rendition. A novelty of the project is the ability to make curved CMOS/OLED displays – we believe that the use of curved displays will in future enable simpler and ultra-compact optical designs for near-eye viewing such as in smart glasses.

Can you tell us more about the manufacturing process?

We would rather not! We can say that a key challenge for the project was the CMOS-OLED

interface – this has to be extremely flat for good yields and device performance. Because larger displays are inherently more expensive to produce, we have also placed great emphasis on attempting to improve yields at every step of the manufacturing process in order to keep the final display cost reasonable.

What were the main difficulties you faced in creating the LOMID chip?

Apart from the CMOS-OLED interface, our biggest challenge was achieving the required bandwidth for the large chip, whilst keeping the circuitry compact and with low power consumption.

Does the device live up to your initial expectations?

Yes! We got the first fully specified project chips (with and without colour filters) towards the end of September and we are very happy with the performance of displays from the first few wafers.

What has been industry's feedback so far?

Very positive. In particular, we showed some interim project results at the Society for Information Display's meeting on 'Wearable and Projection Displays' in Dresden earlier this year, and the feedback we received confirmed that both the new microdisplays and our innovative optical design are meeting market demands. We expect further feedback during the upcoming EFECS event in Brussels from 5 to 7 December 2017, where we plan to demonstrate the LOMID microdisplay chip to the audience.

The project included the creation of smart glasses. Can you tell us more about these?

One of the partners in the project, the Spanish start-up Limbak, has a patented optical approach that allows us to make much more compact head-mounted displays with a very wide field of view. This makes the smart glasses more comfortable and less obtrusive, and enhances the sense of immersion for virtual reality applications. For people that will be wearing smart glasses all day for work, or because they have to for visual prosthetics, it is important that the glasses are comfortable and aesthetically acceptable. Another partner in the project, Oxford University, will test the new microdisplays in smart glasses that will improve the quality of life for blind people, by making the best use of their remaining vision.

What are your plans for commercialisation?

The microdisplays developed by the project will be available from the company Microoled – we expect demonstrator kits to be available from 2018, and we already know of some seriously interested customers. The optical designs can be licensed from Limbak – they are happy to talk to partners about custom designs.

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