the business of photonics
optics.org

celebrating 26 YEARS online excellence

SPRING 2022

AR|VR|MR focus

Delivering the latest news from the AR/VR/MR markets

Credit: BAE Systems.

BAE Systems completes acquisition of Bohemia Interactive Simulations

Credit: XH4D

optics.org: Contact Rob Fisher, Advertising Sales tel: +44 (0)117 905 5330 email: rob.fisher@optics.org

SPIE.

Evaluate display quality by replicating human vision in headsets and smart glasses.

AR/VR Lens

- Photometric imaging solution
- Built for production inspection
- Aperture at the pupil position
- Up to 120° x 80° field of view

RADIANT
VISION SYSTEMS

A Konica Minolta Company

SEE THE DIFFERENCE with Radiant Vision Systems | www.RadiantVisionSystems.com

There's more to AI bias than biased data, says US research agency NIST

As a step toward improving our ability to identify and manage the destructive effects of bias in artificial intelligence systems, researchers at the U.S. National Institute of Standards and Technology have recommended "widening the scope of where we look for the source of these biases — beyond the machine learning processes and data used to train AI software to the broader societal factors that influence how technology is developed."

This recommendation is a core message of a newly revised NIST publication, Towards a Standard for Identifying and Managing Bias in Artificial Intelligence, which reflects public comments the agency received on its draft version, released in 2021.

According to NIST's Reva Schwartz, the revised view on how bias manifests itself goes beyond AI algorithms and the data used to train them, to now include the societal context in which AI systems are used. "Context is everything," says Schwartz, principal investigator for AI bias at NIST.

"AI systems do not operate in isolation. They help people make decisions that directly affect other people's lives. If we are to develop trustworthy AI systems, we need to consider all the factors that can reduce trust in AI."

NIST is planning a series of public workshops in 2022 aimed at drafting a technical report for addressing AI bias and connecting the report with the AI Risk Management Framework. For more information and to register, visit the AI RMF workshop page at nist.gov

Highlights in this issue

Fraunhofer HHI-led group developing AI-based emergency recovery project

The so-called DAKI-FWS joint project to develop a data and AI-supported "early warning system" is designed to stabilize the German economy *(page 4)*.

In business news, BAE Systems has acquired Bohemia Interactive Simulations for $200 million; micro-LED maker Porotech has raised $20 million to accelerate its production; Porotech, a UK startup company developing light-emitting devices based on porous gallium nitride, has closed a new round of venture funding worth $20 million; Kopin, another developer of microdisplays, has reported a sharp increase in annual losses, despite growing its sales; and the II-VI merger with Coherent has been delayed by Chinese regulators – the deal is now expected to close in mid-May, 2022 *(pages 7-10)*.

In ARVRMR innovation news from SPIE Photonics West 2022, Trumpf and Metalenz showcased their polarized VCSEL developments; Jade Bird and Tooz partnered on smart glasses with prescription and full color virtual screens; Edmund Optics launched its Schwarz Mirrors to curb stray laser beams; and Corning showcased a new grade of glass for AR/VR applications *(pages 11-14)*.

Finally, in a new partnership between ARVRMR Focus and the European Machine Vision Association, an article from Werner Feith, EMVA Standards Manager, calls for machine vision industry participation in a new working group to develop an open API standard for portable control over camera systems in multiple markets *(page 18)*.

Matthew Peach, Editor in Chief.
matthew.peach@optics.org

This Issue

Credit: Corning.

Corning upgrades glass for AR/VR applications

2.0 high-index glass allows users to see more through AR wearables by creating larger, clearer images paired with lighter, sleeker device designs.

See article page 14.

Fraunhofer HHI-led group developing AI-based emergency recovery project

DAKI-FWS will be early warning system to steady economy after emergence of sudden crises.

A new project to develop a data and AI-supported "early warning system" is designed to stabilize the German economy. The so-called DAKI-FWS joint project, led by the Fraunhofer Heinrich Hertz Institute (HHI) in Berlin, will use a combination of AI technologies to link and evaluate key data from different data sources.

Based on these data, researchers will develop the early warning system that could be used in future crisis situations such as pandemics or hazardous climate extreme events to better understand and describe their development and course with the aim of protecting and supporting lives and jobs, land and infrastructures, say the partners.

In addition, the system will improve the assessment of the impact of crises on economic aspects. The German Federal Ministry for Economic Affairs and Energy is funding DAKI-FWS as part of the AI Innovation Competition with approximately €12 million.

The Fraunhofer HHI and its Artificial Intelligence department are acting as consortium leaders in the project. DAKI-FWS launched at the beginning of December 2021 and is scheduled to run for three years.

Pandemic projections

For an accurate assessment of the course of the Corona pandemic, experts are currently using reporting data to determine reproduction values and incidence figures as well as to provide estimates of the further course of the pandemic.

Early warning systems, such as those currently used by the Robert Koch Institute, are based exclusively on reporting data from health authorities, using conventional statistical methods to detect outbreaks. However, the recent economic consequences of the Corona pandemic have demonstrated the need to improve this early detection method.

In the DAKI-FWS project, researchers are developing new intelligent detection methods by combining crisis-specific data with socially relevant information, such as mobile phone, traffic, weather and climate data.

In this way, they aim to create an AI-based early warning system to detect pandemic outbreaks and climate extremes such as floods, storms, heat waves and droughts at an early stage, as well as to predict their course more accurately.

Due to the more comprehensive database, experts will be in a better position to make appropriate economic decisions. This means, for example, that value chains may

continued on next page

Credit: Fraunhofer HHI / PhotokinaShutterstock.

Storm warning: The DAKI-FWS system is intended to improve the assessment of the impact of crises on the economy.

continued from previous page

Fraunhofer HHI-led group developing AI-based emergency recovery project

be maintained for longer. Such an early warning system can be applied in almost all sectors (logistics, food supply, sales, services, agriculture, groundwater and drinking water management) and thus strengthen the resilience of the entire German economy.

This type of modular early warning system offers great potential. At the same time, however, it is highly complex and requires the collaboration of many different experts in the consortium to develop powerful data solutions and AI procedures that are acceptable, secure and conclusive. Therefore, the partners involved have the highest quality standards for compliance with the General Data Protection Regulation.

Other AI projects at HHI

With its Artificial Intelligence department, Fraunhofer HHI is assuming overall project management for DAKI-FWS and is furthermore responsible for the development of AI with traffic and weather data. In doing so, the team can build on findings from other research projects: the SAUBER ("clean") project deals with the development of a satellite-based system for displaying, forecasting and simulating air pollutants for sustainable urban and regional development.

In the KLIPS project, researchers are working on an AI-based information platform for the localization and simulation of heat islands for improved urban planning. In addition, as of this year Fraunhofer HHI can draw on the expertise of the new focus group AI for Natural Disaster Management of the International Telecommunications Union, the World Meteorological Organization, and the United Nations Environment Program.

Author:
Matthew Peach, Editor in Chief, optics.org

Credit: FraunhoferHHI/MichaelKompe

Fraunhofer Heinrich Hertz Institute focuses its R&D activities on the key components of multimedia services.

AccuCoat inc.
COATINGS FOR OPTICS

Successfully Coating Wide-Angle AR Optics

AccuCoat's 50-60 degree angle AR coating process provides high technical understanding and the correct equipment for accuracy, repeatability and measurement. Our AR/VR coatings meet MilSpec and ISO standards with the option of hydrophobic durability for increased dependability in the field.

For VR, AR, ADAS high-volume coating needs.

Searching for the right optics coating partner?
Inquire about our proven process today.

accucoatinc.com coatings@accucoatinc.com Rochester, New York

AccuCoat inc.
COATINGS FOR OPTICS

RealWear selects Kopin's Golden Pearl display for its Navigator 500

Developing AR solutions for frontline industrial workers; the upgraded display features a 23-degree field of view and high brightness.

Kopin, a developer of high-resolution microdisplays for AR and VR applications, is supplying RealWear, the leading provider of assisted reality solutions for frontline industrial workers, with the newly updated Golden Pearl display module for RealWear's recently launched RealWear Navigator 500 wearable device. The updated Golden Pearl features a 0.32in, 24-bit full color, high-brightness LCD microdisplay for easy outdoor/sunlight use and comfortable long-term viewing.

"With the launch of the HMT-1, RealWear has become the gold standard for advanced assisted reality head-mounted display systems for industrial use," commented Dr. John C.C. Fan, CEO of Kopin.

"RealWear Navigator 500 enables hands-free work with sophisticated visual support. It's a comprehensive solution to enhance worker productivity. Kopin's power-efficient, high-brightness display module supports full-shift use by providing bright, clear images and information in any lighting condition, including full sunlight."

Andrew Chrostowski, Chairman and CEO of RealWear, said, "When we launched RealWear Navigator 500 with its revolutionary modular design, it made sense to launch using Kopin's next generation offering. Kopin's expertise in microdisplays and optics, including capabilities across multiple microdisplay technologies, has enabled our team to design our human-centric products."

Credit: Kopin.

KopinGolden-Pearl microdisplay for AR and VR applications.

Credit RealWear.

RealWear's new Navigator 500 wearable device allows hands-free worker interactions.

About the partners

Kopin is a provider of wearable technologies and critical components and subsystems for integration into wearable systems for military, industrial and consumer products. The technology portfolio includes ultra-small displays, optics, speech enhancement technology, voice-interface and hands-free control software, low-power ASICs, and ergonomically designed smart headset reference systems.

RealWear develops assisted reality wearable solutions to enable industrial workers to perform tasks more safely, and with increased efficiency and precision. These solutions provide real-time access to information and expertise, while keeping operatives' hands and field of view free for work. Clients include Shell, Goodyear, Mars, Colgate-Palmolive, and BMW, which use the packages to improve workplace safety – "while delivering unprecedented ROI," the developer claims.

Author
Matthew Peach, Editor in Chief optics.org

BAE Systems completes acquisition of Bohemia Interactive Simulations

Acquisition adds software development and advanced military simulation and training to BAE's digital transformation portfolio.

Defense and aerospace technologies giant BAE Systems announced in March, 2022, that it has completed the acquisition of Bohemia Interactive Simulations (BISim) for $200 million, subject to customary closing adjustments.

Credit BAE Systems.

BISim joins BAE Systems, bringing global software development and advanced military simulation solutions.

BISim joins BAE Systems as a wholly-owned subsidiary, bringing global software development and advanced military simulation and training solutions to the company's growing digital transformation portfolio.

"The addition of BISim to the BAE Systems team expands our modeling and simulation capabilities and solidifies our systems integration strategy," said Tom Arseneault, president and CEO of BAE Systems. "With this acquisition, we are even better positioned to meet our customers' evolving needs in the rapidly growing market for global military training, and deliver next-generation virtual systems to help our U.S. military and its allies effectively prepare for future scenarios."

Arseneault added, "The global market for military training and simulation environments and related services is expected to continue growing and surpass $11 billion annually. Our combined capabilities will enable BAE Systems to meet this increasing demand for both military and civilian applications. The BISim purchase also strengthens our position to address the U.S. National Defense Strategy priority to support Joint All Domain Operations."

Credit: BISim.

Bohemia Interactive Simulations develops simulation training systems – using a large in-house team of engineers and the latest game-based technology.

Joint history

BAE Systems and BISim began working together in 2019 on the U.S. Marine Corps War Gaming and Analysis Center contract, and later as part of the BAE Systems Joint All Domain Operations System of Systems research and development project. To best leverage the ongoing collaboration, BISim will join the BAE Systems Intelligence & Security sector.

BISim uses the latest game-based technology and an experienced team of engineers to develop high-fidelity, cost-effective training and simulation software products and components for defense and civilian applications. BISim's market-leading virtual and constructive simulation products are used extensively by more than 60 countries, as well as within all branches of the U.S. military.

This capability not only enhances readiness, but will also allow customers to reduce their CO2 footprint by using simulated training techniques instead of real world training exercises. Headquartered in Orlando, Fla., BISim has an international presence with over 325 employees working in the US, UK, Australia, Czech Republic, and Slovakia, among other countries.

Author:
Matthew Peach, Editor in Chief optics.org

Micro-LED maker Porotech raises $20M to accelerate its production of epiwafers

University of Cambridge spin-out has created porous gallium nitride materials that can be tailored for red, green, or blue emitters.

Porotech, a UK startup company developing a novel class of light-emitting devices based on porous gallium nitride (GaN), has closed a series A round of venture funding worth $20 million.

The cash will be used to accelerate mass production of micro-LEDs based on the firm's "PoroGaN" compound semiconductor material, which are being aimed at applications in augmented and virtual reality (AR/VR) displays.

While GaN-based materials have long been used to fabricate blue and ultraviolet emitters, PoroGaN can be engineered to emit at a much wider range of wavelengths including red and green - meaning that a single material system can be used to produce full-color microdisplays.

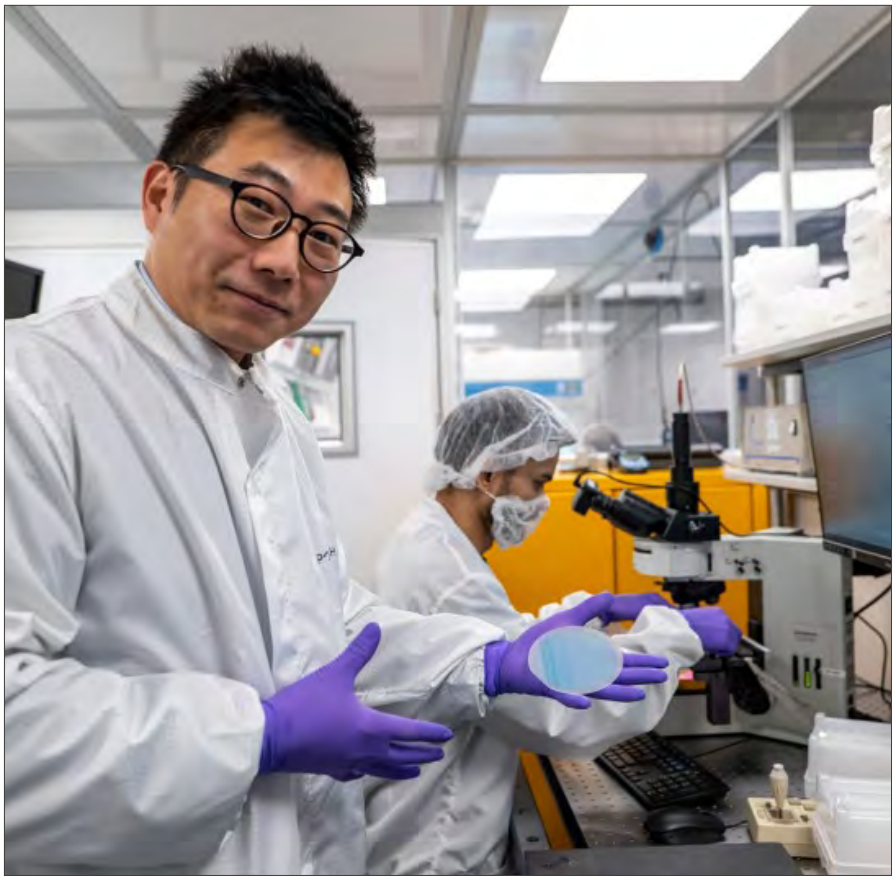


Photo: Porotech.

Porotech CEO Tongtong Zhu, holding an epiwafer based on the company's novel porous gallium nitride material. The wafers can be engineered to emit light at red, green, and blue wavelengths - offering a much simpler way to integrate full-color microdisplays for AR/VR glasses.

RGB from InGaN

Spun out from the University of Cambridge in 2020, Porotech's approach is based around the research of co-founder and chief scientific officer Rachel Oliver, a professor at the Cambridge Centre for Gallium Nitride.

Later that year the company revealed details of its first product, an indium gallium nitride (InGaN) epitaxial wafer featuring red micro-LEDs emitting in the 620-640 nm wavelength range.

In June 2021 Porotech raised £3 million in seed funding, and it now offers epiwafers for green (530 nm) and blue (450 nm) micro-LEDs, all based on the InGaN system.

"Until now, the requirement to mix multiple material systems has complicated the manufacture of full-colour micro-LED displays - making the final products prohibitively expensive for mass-market applications," states the firm.

"Porotech's use of a single material system is a significant leap forward that opens the door to mass manufacturing of micro-LED displays."

CEO and co-founder Tongtong Zhu added: "Porotech's progress during its seed phase has been absolutely staggering – both technically and commercially.

"We have delivered the world's first InGaN-based red micro-LEDs and displays, and have set up production of our first products - shipping to some of the biggest global names in display technology."

Target sector: smart glasses

Zhu says that the new funding round, led by China's Ameba Capital and with additional support from seed investor Speedinvest, will accelerate the development of PoroGaN products for deployment in AR/VR glasses.

Ameba Capital partner Arthur Chen said: "Porotech is poised to transform the $140 billion global display market as it accelerates mass production of its revolutionary micro-LED products.

"The fact that it already has industry leaders among its clients and partners is a testament to the game-changing potential of Porotech's breakthrough."

www.porotech.co.uk

Author:
Mike Hatcher, Business Editor, optics.org

Kopin optimistic after all-plastic 'Pancake' optics launch

But losses widen as microdisplay maker develops new optics and navigates supply chain constraints.

Kopin, the Massachusetts-based developer of optical microdisplays, reported in March, 2022, a sharp increase in annual losses, despite a steady uptick in sales.

For 2021, the firm posted a pre-tax loss of $13.6 million, as increased costs more than offset a 14 per cent increase in revenues to $45.7 million. The equivalent loss figure for 2020 was $4.4 million.

Describing 2021 as "both an exciting and challenging year", long-time CEO John Fan said that so far the company had managed to prevent shipment disruptions due to supply chain constraints.

"The demand for our product is excellent, and our 2022 bookings are very strong," he told an investor conference call discussing the latest results, before warning:

"However, our optimism must be balanced with the issues around the global supply chain, which many industries are continuously facing."

Birefringence problem 'solved'

Part of the reason for the wider loss in 2021 was a sharp increase in research and development spending - partly on Kopin's new all-plastic "Pancake" optics, which can be paired with organic light emitting diode (OLED) microdisplays for augmented and virtual reality (AR/VR) applications.

"In many ways, optics are just as critical as displays in achieving a great AR/VR experience," Fan told investors, adding that the patent-pending technology offered excellent performance while enabling smaller and lighter headgear.

The latest "P80" all-plastic Pancake optics are said to provide a very sharp, 77° field-of-view (FOV) image with very long (23 mm) eye relief and large (12 mm-diameter) eye box - critical parameters for the AR/VR experience.

"We believe our all-plastic Pancake optics are the first in the world, providing critical components for VR headsets," Fan added in the investor call, explaining that previous versions of the optics technology required at least one circular glass lens to avoid creating image defects due to the birefringence of plastic materials.

Glass components tend to add both weight and production complexity to headset designs, while the new two-element Kopin design is said to offer aspherical plastic lenses with virtually no birefringence - meaning better image quality, smaller size, lighter weight and lower cost than anything previously available.

"Providing critical components for VR headsets that are thin, lightweight, comfortable and easy to use has been a long-term objective of ours," Fan said, adding: "I'm glad to say, we have solved the plastic birefringence issue."

Strong order backlog

Kopin has also been working with partners to develop microLEDs, and combined with other efforts Fan said that the firm now has a very strong backlog of orders, and - supply chain issues notwithstanding - expects 2022 to represent another year of solid growth.

In December Kopin booked a $19.8 million order for its eyepiece sub-assembly, described as a critical component in the US Army's "Family of Weapon Sight-Individual" (FWS-I) thermal sight systems.

That system uses a transparent AR optical module that combines the firm's LCDs with customized Pancake optics.

"This is the second large production order received by Kopin for the FWS-I eyepiece sub-assembly," Kopin said at the time, adding that deliveries were mostly scheduled to ship in 2022.

Author:
Mike Hatcher, Business Editor, optics.org

II-VI merger with Coherent delayed by Chinese regulators

Deal now expected to close by mid-May, amid 'constructive' talks with China's antitrust authority.

Image: Element Six.

Diamond deal: II-VI has licensed Element Six's single-crystal growth technology for synthetic diamond production, a technique that will complement its own polycrystalline approach and be of use in high-power optics, among other applications.

The merger of two of the largest companies in the photonics sector - US-headquartered II-VI and Coherent - is now expected to close around mid-May this year, after further delays gaining clearance for the deal in China.

Agreed last March following a protracted bidding war, the merger was initially expected to close by the end of 2021. That date was then pushed back to the opening quarter of this year, before II-VI revealed the additional delay when it released its latest quarterly financial results on February 9.

Despite the delay, II-VI CEO Chuck Mattera indicated that in three out of the four jurisdictions where antitrust clearance is needed approval was either in place already or imminent, and that talks in the fourth - China - were progressing well.

"II-VI and Coherent are continuing to work constructively with the State Administration for Market Regulation ("SAMR"), and we now anticipate closing the acquisition by the middle of the second calendar quarter of 2022," said Mattera. "We are ready and set to go."

Pump lasers and transceivers

Meanwhile, Mattera and his executive team reported sales of $807 million for the three months ending December 31, up slightly on the same period in the previous year.

And the CEO told an investor conference call that II-VI sales would have exceeded $840 million, if not for supply-chain and Covid-related disruptions that accelerated during the December quarter. Pre-tax earnings of $79.4 million were down from $106.3 million in the prior year.

The Pittsburgh-based firm, which sells a vast range of photonics products and specialist materials for electronics production, also received bookings worth more than $1.1 billion, a new record.

"Products for the industrial and communications markets led our growth year-over-year," said Mattera, adding that the company shipped a record-breaking 100 megawatts of pump laser power in the quarter.

"The strong demand for transceivers in hyperscale datacenters and artificial intelligence superclusters continues unabated," added the CEO. "Our sales of 200G, 400G, and 800G transceivers now represent about a third of our datacom transceiver business."

Mattera is also expecting significant growth in shipments of ROADMs [reconfigurable optical add-drop multiplexers] this year as faster optical networks are built, and the constrained supply of electronic components needed for those products eases.

He added that demand for photonic components used in 3D sensing applications remained strong, with more opportunities for a broader set of products now arising as the technology migrates from consumer electronics to industrial and automotive markets.

In the emerging area of augmented and virtual reality, II-VI chief strategy officer Giovanni Barbarossa added that one major customer had committed to fund the company with around $50 million to develop and produce a broad range of new products, including lasers, diffractive optics, and advanced materials.

Turning to the industrial sector, Mattera said II-VI had experienced "explosive" growth in orders from semiconductor capital equipment manufacturers, and from their top-tier suppliers, for both front-end and back-end semiconductor wafer processing tools - including for extreme ultraviolet (EUV) lithography applications.

Diamond optics

II-VI has also signed a licensing deal with UK-based synthetic diamond producer Element Six that will complement II-VI's existing expertise in the hard-to-produce material.

While II-VI offers products based on polycrystalline diamond, Element Six has been developing a single-crystal alternative for decades.

Steve Rummel, a senior VP at II-VI with responsibility for the firm's engineered materials and laser optics business unit, said of the Element Six approach: "Its unique capabilities complement II-VI's proprietary polycrystalline diamond, a material we already manufacture at scale."

Element Six chief technologist Daniel Twitchen added: "Besides future opportunities for electronics, there is also a wide range of near-term applications driving the demand for accessible high-quality single-crystal diamond, including high-power optics, high-durability parts, and high-performance thermal-management systems."

Looking ahead, the II-VI executive team said that sales in the March quarter should end up somewhere between $785 million and $825 million, and limited as supply chains remain squeezed for certain key components.

Those constraints will also see the company increase prices in some areas, including products for both optical communications and semiconductor capital equipment applications.

- Following the update on February 9, 2022, II-VI's stock price rose in value by around 6 per cent on the Nasdaq. Trading at around $69, the firm's market capitalization stands close to $7.5 billion.

Author:
Mike Hatcher, Business Editor, optics.org

Trumpf and Metalenz showcase polarized VCSEL possibilities

Vertical-cavity surface-emitting lasers could play a key role in future consumer electronics devices.

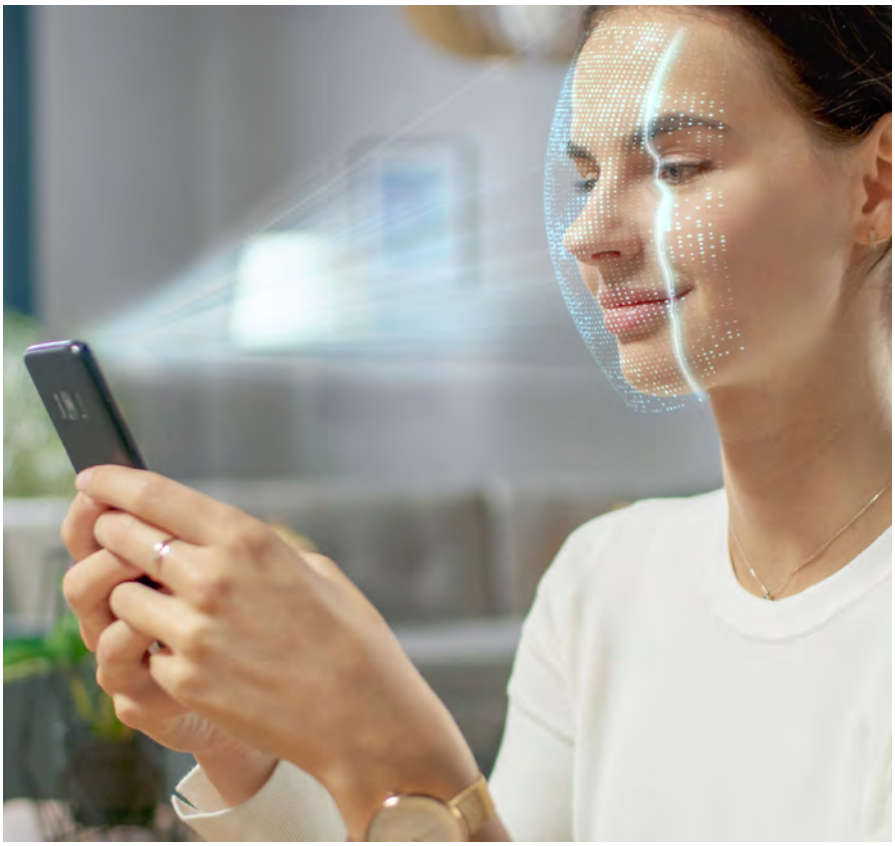
Laser giant Trumpf has teamed up with Boston-based Metalenz, the meta-optics spin-off from Federico Capasso's Harvard University laboratory, to show how a combination of the next-generation advanced optics and VCSELs (vertical-cavity surface-emitting lasers) might play a key role in future consumer electronics devices.

At the Trumpf booth during Photonics West, the two companies jointly presented a live showcase featuring VCSELs with controlled polarization for illumination applications. "This new VCSEL will lead to much smaller construction space needed, for example, in smartphones for 3D scene illumination," they say.

Spun out of Harvard in 2016, Metalenz is regarded as the first company to commercialize meta-optics. Capasso and his colleagues came up with the concept behind the extremely thin, flat optical components, initially to save space and lessen the weight of optical systems on board drones.

Last year the startup signed a co-development and licensing agreement with semiconductor maker STMicroelectronics to integrate its meta-surface optics technology into STM's existing diffractive optics manufacturing process at its large-scale wafer fab in Crolles, France, initially for applications in near-infrared sensing. The lenses manufactured at the site feature nanostructures just one-thousandth the thickness of a human hair.

Trumpf, which acquired its VCSEL expertise through the 2019 buy-out of Philips Photonics, sees a growing range of advanced industrial and consumer sensing applications for the tiny emitters, as tailored illumination profiles can be created," Trumpf said. The company is also showing off VCSEL heating systems this week in San Francisco, an approach that enables direct heat treatment with fully controllable emission zones. The idea is said to offer huge potential for a variety of industrial applications, including more sustainable lithium-ion battery production, local softening of metal automotive parts, and photovoltaics.



Credit: Trumpf / Metalenz.

Trumpf and Metalenz showcased a live demonstration of illumination for smart phone applications at Photonics West 2022.

ranging from oxygen sensing to facial recognition.

Under its Trumpf Photonic Components division, the laser firm's portfolio now features a new single-mode VCSEL for highly precise time-of-flight sensors. Another new offering is called "ViBO" (short for VCSEL with integrated backside optics), which includes monolithically integrated micro-optical elements and is aimed at emerging photonics applications in fast-growing end markets.

"Applications such as lidar or augmented reality glasses benefit from this technology, as ViBO comes with a significantly reduced footprint and offers [the] highest freedom in design,

For battery manufacturing, the high-power VCSELs enable faster and more energy-efficient drying of active material, which leads to a more efficient overall production. Finally, Trumpf has combined VCSELs and photodiodes for use in optical communications, more specifically for low power consumption and low latency in data centers.

Author
Mike Hatcher, Business Editor, optics.org

Curved waveguide enables prescription AR glasses

Jade Bird and Tooz partner for a new generation of smart glasses with prescription and full color virtual screens.

Credit: Tooz Technologies.

Spex appeal: JBD and Tooz Technologies have combined a curved waveguide including prescription with a polychrome display engine featuring x-cube optics and a red, green, and blue microLED display panel.

Shanghai's Jade Bird Display (JBD), a participant in the SPIE AR|VR|MR event collocated with January's Photonics West, has teamed up with Tooz Technologies — a joint venture between Zeiss and Deutsche Telekom — to produce prescription AR glasses based around a novel curved waveguide.

Under the newly formed collaboration, JBD and Tooz say that they are the first to achieve the technological feat. "The combination of the color microLED display engine by JBD and the curved waveguide by Tooz enables sharp, full-color virtual screens while keeping a slim and stylish form factor and fulfilling the essential function — individual vision correction — of everyday glasses," they announced, with the first public demonstration of the glasses at AR|VR|MR.

For the joint solution, JBD provides a display engine that combines three monochrome microLED display panels with an x-cube optic to create a polychrome display. The red, green, and blue 0.13- inch panels are aligned to the sides of a 5 mm x-cube, resulting in a total volume of just 0.72 cubic centimeters.

The JBD module is then attached to the curved waveguide lens by Tooz. "With several high-precision, free-form surfaces, the lens guides the light from the x-cube to the wearer's eye without the need for any additional separate optical elements," explain the two firms. The Tooz device is said to be the only curved waveguide lens on the market that allows seamless integration of vision correction.

Credit: Jade Bird

Qiming Li: satisfied with Photonics West interest.

The partners claim that their combination of technologies delivers unprecedented brightness of the virtual image, without compromising either transparency or power consumption. One reason for this, they add, is optimization of the wavelength-dependent efficiency of the waveguide to the individual display characteristics. This allows the red microLED color to be boosted.

Tooz, which launched its first pair of smart glasses for developers in 2020, says it has already proved that it is able to design and produce optical platforms that enable cost-effective, fully functional products. The next step was to make glasses suitable for all-day wearing, both in terms of wearer comfort and power consumption.

"With the energy-efficient combination of waveguide and x-cube, the virtual information screens in the wearer's field of view can be multi-colored, allowing for a versatile visualization of the user interface," say the two firms. "Further, the screens are brighter compared to former displays while consuming less battery power."

That decrease in power consumption is said to allow for all-day usage of the smart glasses in a slim and stylish form factor — including prescription vision correction.

JBD CEO Qiming Li and Tooz CTO Frank-Oliver Karutz demonstrated the first results of the newly formed strategic partnership in a joint presentation in the Consumer Electronics session at SPIE AR|VR|MR Conference collocated with Photonics West, in January 2022.

After his booth at AR|VR|MR proved a popular destination for visitors, Qiming Li was full of praise for the event. "We had also exhibited at CES this year but the volume and quality of leads here is much greater," he said.

www.jb-display.com

Author
Mike Hatcher, Business Editor, optics.org

Edmund Optics debuts its Schwarz Mirrors to curb stray laser beams

Components distribution giant uses Photonics West 2022 to showcase its latest optical system mirrors.

In laser applications, unwanted transmission can require a "beam dump" to be positioned behind every mirror to prevent unwanted light propagation. Novel mirrors called Schwarz Mirrors (patent pending) based on an engineered substrate — developed by Edmund Optics *(Booth 627)* — can reduce the power leaking through a component by several orders of magnitude while maintaining >98 percent of the reflective properties.

The Schwarz Mirrors will launch with a 25.4mm diameter x 6.35mm thick sample, with a VIS coating (350-700nm). The substrate itself is an engineered fused silica that is black in appearance; it has identical properties to traditional fused silica (including its characteristic lower thermal expansion and high durability) with the added benefit of having OD7 blocking in the visible range.

Credit: Joey Cobbs

Ian Schwartz, Product Line Engineer says the mirrors will be "very popular in the defense sector."

Ian Schwartz, a product line engineer at Edmund Optics, explained, "The primary applications are laser safety, stray light control, and reduction of optical system size per cost. We expect these to be very popular in the defense industry as well as laser manufacturing and autonomous vehicles."

Rated as both mirrors and neutral density filters, these parts greatly reduce the need for beam dumps behind components, minimizing the size of optical systems and improving laser safety. The products are making their debut this week and a soonto-be published paper will discuss the performance of these engineered mirrors and compare their reflection and transmission with traditional fused silica mirrors.

Likely markets for the Schwarz Mirrors will be in laser development, augmented and virtual reality display systems, and the wider OEM manufacturing sector.

www.edmundoptics.com

Author:
Matthew Peach, Editor in Chief optics.org

TRIOPTICS
See the Difference

Performance testing of Augmented Reality devices

ImageMaster® Lab AR Flex

- The worldwide standard for testing optical components, modules and devices in the field of Augmented Reality
- Testing of waveguides, light engines and Near-Eye Displays
- Suitable for manufacturers and integrators as well as for independent testing laboratories
- Precise measurement of image quality (e.g. MTF, sharpness, homogenity, contrast, color, distortion) and efficiency of waveguides

www.trioptics.com
A member of the JENOPTIK Group

Corning upgrades glass for AR/VR applications

2.0 high-index glass allows users to see more through AR wearables by creating larger, clearer images paired with lighter, sleeker device designs.

The glass and materials giant Corning chose the Photonics West exhibition to launch a new higher-index glass for augmented, virtual, and mixed reality (AR/VR/MR) applications that is said to create larger, clearer images and enable lighter, sleeker device designs.

The new glass joins the company's existing AR/MR portfolio, which also features high-index compositions with refractive indices of 1.8 and 1.9. Corning has previously supplied the high-index glass for companies such as UK-based WaveOptics, which is now part of software giant Snap, Inc.

Credit: Corning.

Corning has expanded its high index glass portfolio to drive adoption of AReality technologies.

The new glass features a refractive index of 2.0, enabling a wider field of view (FOV) and light transmission at blue wavelengths, claims the firm. The glass is a critical optical element in AR glasses and headsets, and used in diffractive waveguides.

"Optical advancements inherent in the glass take the augmented reality experience to the next level through larger, clearer digital content that creates more engaging and immersive user experiences," said the company, which showcased the new material for the first time in 2022.

WaveOptics said previously that the flatness, refractive index, and parallelism of the waveguide glass produced by Corning are all crucial for ensuring image quality with low scatter and high contrast.

Compared with lower-index glass, companies designing AR/VR/MR glasses and headsets should now be able to achieve a larger FOV with fewer pieces of glass, meaning that their resulting hardware should be both lighter and cheaper to produce.

"Corning's 2.0 glass composition, as well as its comprehensive solutions for flatness metrology and precision laser glass cutting will further enable the AR/MR industry, bringing mass consumer adoption one step closer," the company said, adding that the new material was available in wafer diameters of 150mm, 200mm, and 300mm, in a range of thicknesses and with leading geometric tolerances.

David Velasquez, company VP and general manager at Corning Advanced Optics, added: "Our technologies bring the detail below the surface to life. Over the next several years, through new glass compositions, supporting capabilities, and innovative solutions, Corning will help enable the adoption of AR into our daily lives.

"These headsets require very precise, very flat glass in the eyepiece for a wide FOV and superior image quality, and our extensive knowledge of glass allows Corning to drive innovation in this application space."

Author

Mike Hatcher, Business Editor, optics.org

NIL Technology demonstrates metalens camera module

Innovative optical technology now ready to be designed into commercial applications.

Camera developer NIL Technology presented a complete imaging system based around a metalens component at its Photonics West booth, and says that it will be ready to begin mass production of the metalenses this year.

The Copenhagen, Denmark, company says that the novel camera proves that the innovative optical technology is now ready to be designed into a variety of commercial applications — such as mobile 3D sensing, facial recognition, eye tracking, near-infrared security imaging, driver monitoring systems in cars, and industrial machine vision.

The compact camera module consists of NIL Technology's 1M metalens, a commercial CMOS image sensor from a leading supplier, and an infrared bandpass filter centered around 940 nm. The USB camera is also illuminated by a commercial VCSEL array. The exhibition demo showed a live video feed from the camera module on a large monitor, and included both technical targets and everyday items.

Three of the company's senior representatives discussed the metalens technology in technical presentations at the show. NIL Technology CEO and co-founder Theodor Nielsen presented details of the latest developments during an invited talk at the SPIE AR|VR|MR event.

The company's head of optics, Ulrich Quaade, discussed the optical efficiency of metalenses for imaging applications at infrared wavelengths during a presentation on January 26 in the Photonic and Phononic Properties of Engineered Nanostructures XII conference.

Meanwhile Brian Bilenberg, the firm's executive VP of mastering and also a co-founder, presented a poster at the AR|VR|MR event covering uniformity control of large area diffraction gratings for augmented reality surface relief waveguide masters.

Company recognized

In January 2022, NIL Technology was selected from more than 3,000 candidates to be part of the EIC ScalingUp program, a project by the European Innovation Council for the most promising deep-tech companies in Europe. The selection was made in recognition of NILT's "disruptive technology and exponential growth potential and follows a financing round of €26 million (USD 31 million) in the technology last year," the company stated.

NILT also recently announced breakthrough innovations in flat optical solutions for 3D sensing made by meta and diffractive optics. The company says it is taking the lead in the development and mass production of highly efficient, compact, and flat optics to accelerate the commercial use of novel optical solutions.

www.nilt.com

Author:
Matthew Peach, Editor in Chief, optics.org

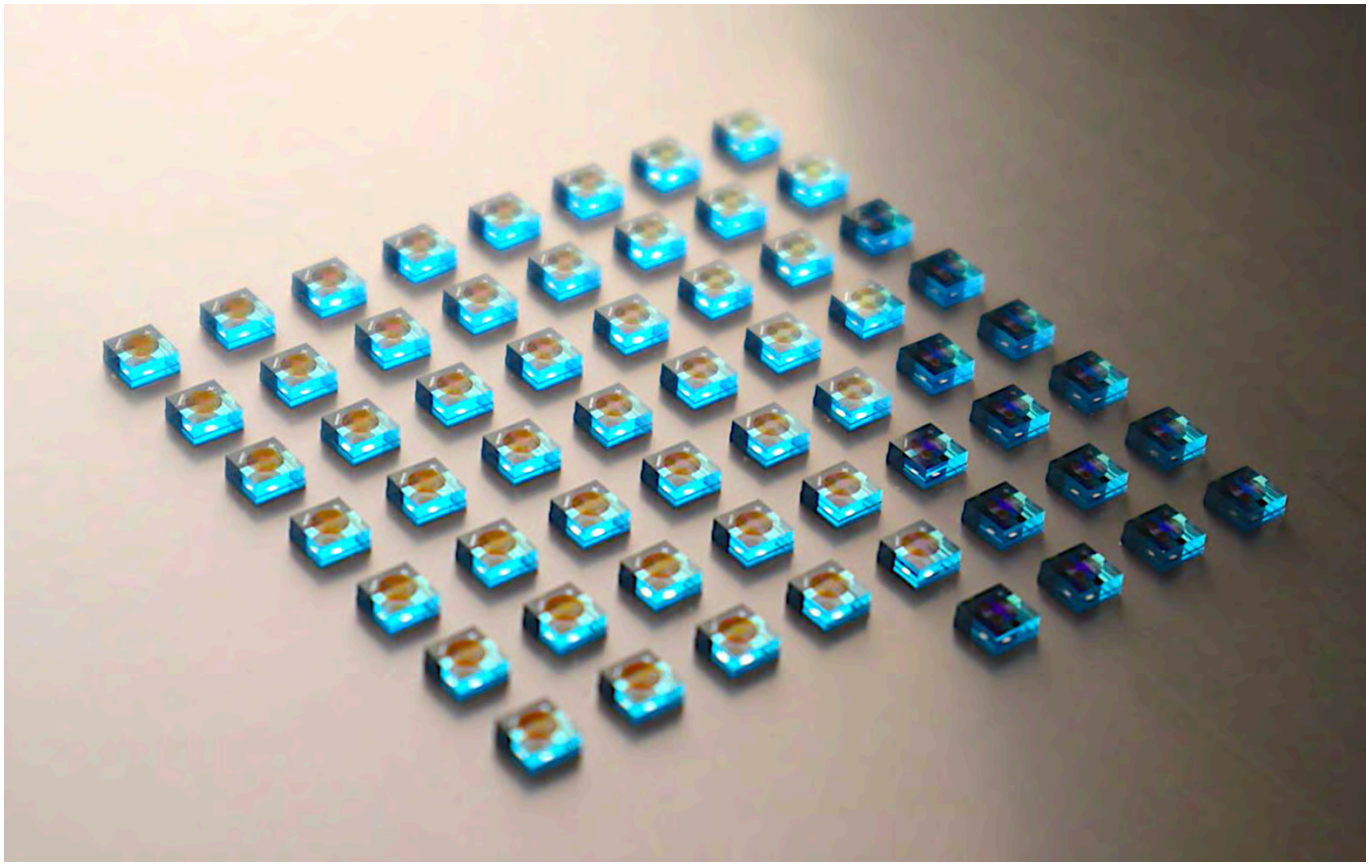


Photo: NIL Technology.

Close-up of NILT's "1M" metalens component, used inside the camera module being demonstrated at the company's exhibition booth this week in San Francisco.

Nanoimprint tool for AR waveguide production

The EVG 7300 SmartNIL nanoimprint and wafer-level optics system combines multiple UV-based processing capabilities.

Austrian manufacturing systems developer EV Group (EVG), which specializes in wafer bonding and lithography equipment for the MEMS, nanotechnology and semiconductor production, says its new "EVG 7300" automated system for nanoimprint lithography and wafer-level optics is now available to order.

Described as the firm's most advanced tool that combines multiple UV-based process capabilities, including NIL, lens molding, and lens stacking in a single platform, it is being aimed at applications in both research and production settings.

Potential uses could include the manufacture of optical sensors and projectors, automotive lighting optics, waveguides for augmented reality (AR) headsets, biomedical devices, metaoptics, and optoelectronics.

Compatible with wafer sizes up to 300 mm in diameter, the equipment provides high-precision alignment, advanced process control, and high throughput. "The EVG 7300 meets the high-volume manufacturing needs for a variety of free-form and high-precision micro-optical components and devices," states the firm.

Thomas Glinsner, corporate technology director at EVG, claims that the new tool offers the most precise alignment and process parameter control on the market, providing customers with unprecedented flexibility for either research or production requirements.

Credit: EV Group.

EVG's latest nanoimprint lithography equipment could be used to produce waveguides for AR headsets, metalens optics, and several othe micro-optical components.

During SPIE AR|VR|MR Glinsner gave an invited talk on the benefits of the system for AR waveguide production.

The EVG 7300 is said to feature industry-leading alignment accuracy down to 300 nm, enabled by a combination of alignment stage improvements, high-accuracy optics, multipoint gap control, and non-contact gap measurement.

Author:
Mike Hatcher, Business Editor, optics.org

- Unmatched optimization and tolerancing algorithms
- Reliable results in less time
- Cost-to-manufacture savings

Email **optics@synopsys.com** to request a free trial
or visit **synopsys.com/optical-solutions.html.**

SYNOPSYS®

Micledi Microdisplays and GlobalFoundries collaborate on displays for AR glasses

Partners' technology combination offers capabilities to mass-produce microLED arrays.

Micledi Microdisplays, a developer of microLED arrays for augmented reality glasses, has announced a manufacturing collaboration with GlobalFoundries to enable AR glasses to achieve the brightness, resolution, power, and size to become affordable for consumers, say the partners.

Under the agreement, Micledi's microdisplay array will be combined with GF's 22FDX platform that provides the performance, ultra-low power and feature integration capability needed to build Micledi's microLED arrays in mass production.

Micledi says that such companion integrated circuits, which can be customized for different customer applications, "will provide the image processing, driver and control functions needed to complete the display modules using wafer-to-wafer hybrid bonding."

The overall global AR market is estimated by analyst Markets And Markets Research to reach a total sales value of $88.4 billion by 2026 with a CAGR of 31.5% from 2021 to 2026 as it becomes the next consumer platform.

Ed Kaste, VP Industrial & Multi-Market at GlobalFoundries, commented, "Demand for AR and VR products will soar as users experience more immersive augmented reality. Micledi's microLED solution, combined with GF's 22FDX platform, addresses the demanding needs of future AR glasses by providing ultra-high resolution displays and advanced imaging technology that make stunning visual detail and color possible."

Sean Lord, CEO at Micledi, said, "We are pleased to collaborate with GF as we move from pilot-line manufacturing to mass production in a world-class fab. To enable optimum microdisplays for AR, we have developed a unique and innovative solution for microLED manufacturing integrating both the controller IC and emitter module to leverage GFs 300mm semiconductor manufacturing technology."

Target market: augmented reality

Micledi is a fabless developer of microLED display modules for the augmented reality market. The company was spun-out from imec, a nanotechnology and photonics technology research center, based in Leuven, Belgium, in 2019.

The technology is based on an innovative combination of III/V materials processing, 3D integration and 300mm silicon-based processing combined with a proprietary ASIC to provide a self-contained, compact monolithic AR display with high image quality and power efficiency.

Author:
Matthew Peach, Editor in Chief, optics.org

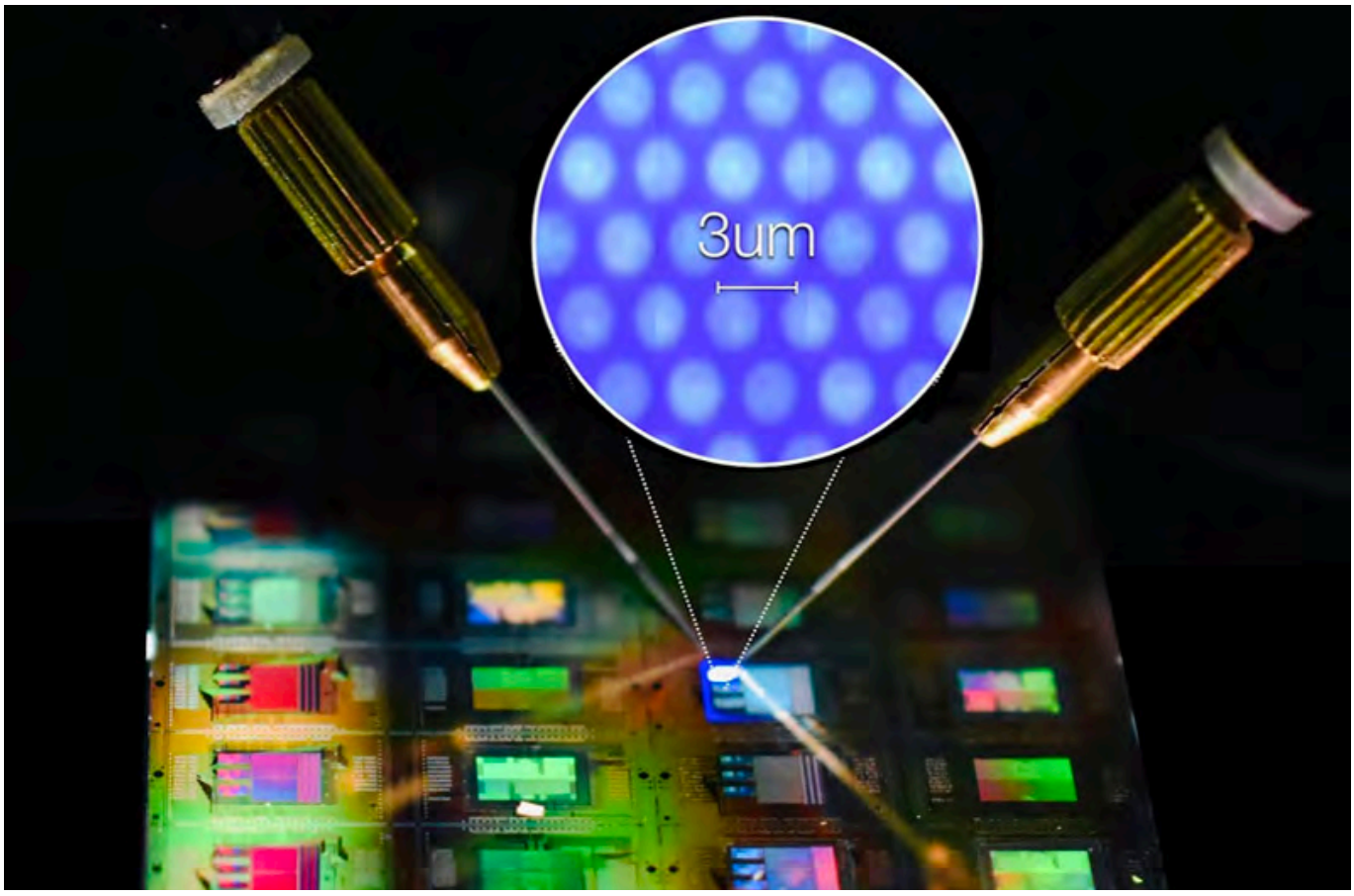


Image: Micledi Microdisplays BV.

MicroLED arrays for AR built on a 300mm CMOS manufacturing platform.

Press Release

Machine vision: Call for participation in new camera API working group

- **EMVA and Khronos Issue Call for Participation for New Camera API Working Group**
- **Strong industry consensus to develop an open, cross-vendor API standard for portable control over camera systems in multiple markets.**

Credit EMVA

Werner Feith, EMVA Standards Manager.

The European Machine Vision Association (EMVA), the leading European industry association dedicated to vision technology, announces the formation of a new Working Group together with the Khronos® Group, an open consortium of industry-leading companies creating advanced interoperability standards, to develop an open, royalty-free API standard for controlling camera system runtimes in embedded, mobile, industrial, XR, automotive, and scientific markets.

The Working Group will be hosted by the Khronos Group and is the result of an EMVA/Khronos-hosted Exploratory Group, held in 2021, during which over 70 companies participated to develop a Scope of Work document that will guide the direction of the API design. Design work of the Working Group commenced operations in February 2022, and any organization is invited to join to participate.

The background to form this Working Group is that cameras are increasingly critical in diverse industries, motivating the development of increasingly sophisticated optical systems, image sensors and vision processors often utilizing machine learning technology. However, the lack of interoperable camera API standards increases application development time and maintenance costs while reducing portability and opportunity for code reuse, resulting in unnecessarily high integration costs for camera technologies.

The new Camera API will be designed to provide applications, libraries and frameworks low-level, explicit control over camera runtimes, with a low-level of abstraction that still provides application portability over a wide variety of camera systems with effective, performant control to generate streams of data for consumption by downstream applications and clients.

"The close and productive collaboration between the EMVA and Khronos has been very effective in enabling broader industry participation and diversity of perspectives at the Embedded Camera Exploratory Group than either organization could have achieved working alone," said Chris Yates, EMVA president. "EMVA will continue our collaboration with Khronos under a new liaison agreement to ensure that the interests of both the EMVA membership and the wider industry are represented at the new Camera API working group."

"The Embedded Camera API Exploratory Group followed the Khronos New Initiative Process with invaluable cooperation from the EMVA. Over seventy companies worked together from March to December 2021 to forge strong industry consensus on the need, terminology, scope, requirements and design methodology for a new open standard camera system API," said Neil Trevett, Khronos president. "Now, we warmly invite any interested companies, vendors and developers to bring their voice and their expertise to the design phase of this important work."

The Camera API Working Group will start meetings in February 2022 and is expected to be of particular interest to sensor or camera manufacturers, silicon vendors, and software developers working on vision and sensor processing. Any organization is welcome to join Khronos and participate in this global initiative under the consortium's multi-company governance process. More details can be found on the Khronos membership page or through contacting Khronos Membership Services.

Industry Support for the Camera API Working

Over 70 companies participated in the Camera Exploratory group and the following companies support establishing the Camera API Working Group: Adimec, Almalence Inc., Analog Devices Inc., Basler AG, Baumer Optronic GmbH, Cadence Design Systems, Inc., Collabora, Digica, Digital Air Technologies, Euresys, European Machine Vision Association, FLIR Integrated Imaging Solutions, Google, Groget, Holochip Corporation, Ideas on Board Oy, LunarG, Inc., MATRIX VISION, MM Solutions, MVTec Software GmbH, NVIDIA, Perey Research & Consulting, Phil-Vision, Pleora Technologies, Raspberry PI Ltd, STEMMER IMAGING, Texas Instruments, VeriSilicon, Vision Components.

"The generic camera API will help Adimec to focus on our mission to deliver the right image in the right place at the right time, so our customers can focus on their imaging tasks. That is what we call 'Excellence in Imaging'," – The Adimec Team.

"Lack of API standards for advanced

continued on next page

continued from previous page

Machine vision: Call for participation in new camera API working group

use of embedded cameras and sensors is an impediment to industry growth, collaboration and innovation. Enterprise AR customers and systems integrators/value added providers will benefit from greater clarity, open interfaces between modular systems and innovation in the component provider ecosystem. This Khronos standard for camera and sensor control will increase opportunities for powerful new combinations of sensor and AR compute resources, integration with existing IT, and lower cost and complexity of future solutions," Christine Perey, interoperability and standards program leader for the Augmented Reality for Enterprise Alliance (AREA).

"Open interface standards such as GenICam or GigE Vision have been a key element to establish a professional Machine Vision Market. Only by such standards we can ensure the interoperability of products from different vendors. It helped to shorten the development cycles of customers dramatically and also yields in a faster growing market. Therefore we strongly support the new open standard camera API initiative driven by Khronos and the EMVA," Arndt Bake, CDO, Basler AG.

"Over the past two decades, digital cameras used in embedded applications have changed dramatically. As video capture quality and processing power have increased, so has the potential for enhanced features which were unimaginable in early camera phones. The proliferation of features has resulted in a corresponding plethora of software support. The Embedded Camera Exploratory Group has laid the foundations for a consistent and extensible API to resolve this complexity; Digica is pleased to have contributed to this project and welcomes the development of the API under the new Working Group," Jim Carroll, CTO, Digica.

"Due to high fragmentation and lack of standardization, the embedded camera space is subject to painful interoperability issues. Adding camera support in a product is complex and expensive, most often subject to vendor lock-in, when not practically impossible for small actors. Ideas on Board launched the libcamera project three years ago to address these issues in the Linux mobile, embedded and desktop ecosystems. We have contributed our experience to the Khronos Camera Exploratory Group, and are looking forward to continuing collaboration with the industry on a new open standard camera API," said Laurent Pinchart, CEO, Ideas on Board, and lead architect of the libcamera® project.

"Cameras are everywhere and in everything, the market and applications have exploded in the last ten years. But a cohesive set of standard APIs has been slow to emerge making incompatibility challenging. Khronos, in conjunction with the European Machine Vision Association, is going to correct that and has formed this Working Group to develop an open API for cameras. This will be welcome news to industry participants and users alike," said Jon Peddie, president, Jon Peddie Research.

"Existing standards, like GigE Vision and USB3 Vision, have proven that a standardization of software interfaces is beneficial for manufacturers and users. We believe that, in the rapidly changing world, Embedded Vision is significantly shaping the future of machine vision. A complementary standard for the embedded camera API is therefore important, and it makes camera control more reliable, hardware selection more flexible and shortens users' time-to-market," said Tilman Sanitz, head of embedded systems, Matrix Vision.

"A widely supported open standard camera API will spur innovation and reduce integration costs in multiple markets that use advanced sensors. NVIDIA has supported the work of the Exploratory Group and is committed to participating in the design work at this new Camera Working Group," Sean Pieper, director of imaging software, NVIDIA.

"With the strong growth of camera applications in automotive, IoT, AR/VR devices, wearables and smartphones, there has been a strong demand for a standardized camera API in the industry. The standardized camera API that the Khronos group is working on will help facilitate the deployment of new cameras by reducing porting efforts, simplifying the procedures of camera upgrades, and improving the interoperability among various camera devices. This camera API standardization effort is very meaningful and will be highly influential to the related industry. We would like to see this standard API to be deployed soon," said Weijin Dai, EVP, VeriSilicon

About EMVA

The European Machine Vision Association is a non-for-profit and non-commercial association representing the Machine Vision industry in Europe. The association was founded in 2003 to promote the development and use of vision technology in all sectors, and represents members from within Europe, North America, and Asia.

The EMVA is open for all types of organizations having a stake in machine vision, computer vision, embedded vision or imaging technologies: manufacturers, system and machine builders, integrators, distributors, consultancies, research organizations and academia. All members – as the 100% owners of the association – benefit from the networking, cooperation, standardization, and the numerous and diverse activities of the EMVA. The EMVA is the host of four global machine vision standards: The two widely established standards GenICam and EMVA 1288 as well as the two standardization initiatives Open Optics Camera Interface (OOCI) and Embedded Vision Interface Standard (emVision).

About Khronos

The Khronos Group is an open, non-profit, member-driven consortium of over 180 industry-leading companies creating advanced, royalty-free, interoperability standards for 3D graphics, augmented and virtual reality, parallel programming, vision acceleration and machine learning. Khronos activities include 3D Commerce™, ANARI™, glTF™, NNEF™, OpenCL™, OpenGL®, OpenGL® ES, OpenVG™, OpenVX™, OpenXR™, SPIR-V™, SYCL™, Vulkan®, and WebGL™. Khronos members drive the development and evolution of Khronos specifications and are able to accelerate the delivery of cutting-edge platforms and applications through early access to specification drafts and conformance tests.

www.khronos.org

Contact
EMVA – European Machine Vision Association
Gran Via de Carles III, 84
08028 Barcelona
Spain
E-mail: **Khronos@castercomm.com**
Web Site: **https://www.emva.org**

SPIE.

digitally connected...

After a period of unpredictable change, it remains vitally important to stay digitally connected with your customers.

As the leading online resource for professionals using photonics-based technologies, applications and for the diverse markets they serve, optics.org offers a comprehensive range of digital marketing solutions to support and drive your marketing strategies.

Contact our Sales team today to discuss how optics.org can help you create a targeted customer experience and put your brand and products in front of key decision makers.

...socially undistanced.

the business of photonics
optics.org

Visit us at

SPIE Defense + Commercial Sensing
Orlando, USA
Booth #707 3 - 7 April 2022

Laser World of Photonics
Munich, Germany
Booth #B5.527 26 - 29 April 2022

optics.org
e: rob.fisher@optics.org
t: +44 (0)117 905 5330
f: +44 (0)117 905 5331

celebrating 26 YEARS online excellence