MicroLED Association

White paper:

MicroLEDs 2025: state of the industry and future roadmap

Non-member Summary

MicroLEDs 2025:
State of the industry and future roadmap

By the MicroLED Industry Association (MIA)

MicroLED Association

This document will provide an overall look at the status of the MicroLED industry and market, as well as projections for the future.

MicroLED is a relatively nascent next-gen display technology, meant to replace incumbent technologies like LCD and OLED while offering improved performance – mainly in terms of efficiency, lifetime and brightness. Despite ongoing research and R&D (which has been going on for over a decade), it seems that mass production is still years away with several unsolved challenges to overcome [1]. It remains to be seen which processes and technologies will ultimately become prevalent in the industry.

*This report was written by the **MicroLED Industry Association**, a collaborative consortium that aims to support the adoption of microLED display technologies. The Association brings together companies, academia and organizations active in the MicroLED space and provides a forum for solving common technology issues, fostering cooperation and sharing relevant information, resources and tools.*

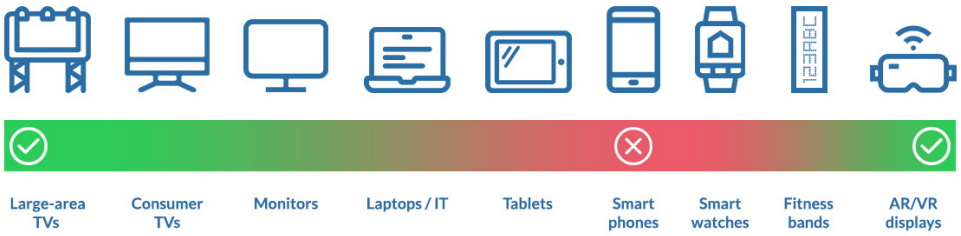
The number of displays currently being sold is very small, as high manufacturing costs and low production capacity limit the use of MicroLEDs in most markets. Nevertheless, this document will describe the existing market and attempt to give projections for the future. In the LCD and OLED industries, most of the displays are manufactured using more or less similar techniques. In the MicroLED industry, however, a larger number of manufacturing technologies exist, as well as different architectures [2]. It is plausible that as the MicroLED industry matures, different companies will still choose various different technologies and architectures, and it is also possible that displays meant for different applications will be different in terms of manufacturing and architecture. This could potentially harm the accuracy of our projections, but we hope this document can help decision makers to understand the various options and the future of the MicroLED industry in a way that will be valuable [3].

MicroLED Market and Industry Landscape, 2025

Despite Billions of dollars already invested in R&D in recent years, the state of the MicroLED market is still quite preliminary. Currently, some microLED displays are produced commercially, all targeting the following segments, and all produced in very low volumes still:

1. Microdisplays, or near-eye displays
2. Displays meant for smartwatches or other wearable solutions
3. Ultra large area TV and signage tiled displays
4. Transparent displays

Albeit counterintuitive, it is easier and more cost effective for the MicroLED industry to manufacture displays that are either very small or very large. “in-between” sizes tend to be more challenging.



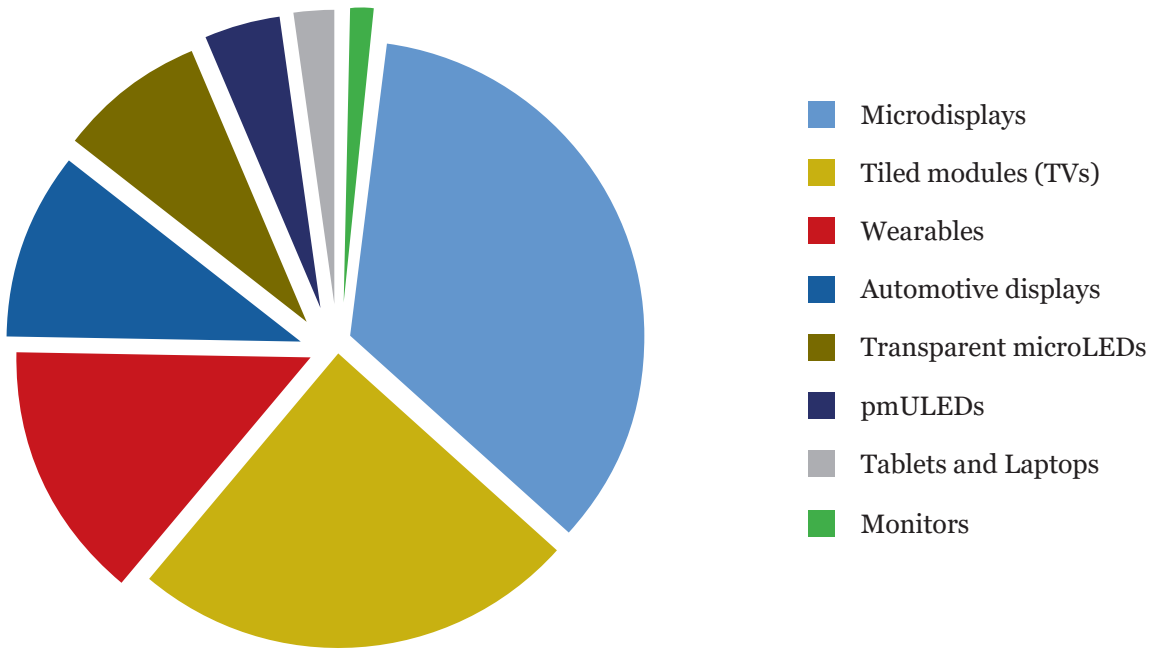
In the case of MicroLEDs, commercial production does not mean large quantities. Looking at the whole of 2024, it can be estimated that the number of produced MicroLED TVs or MicroLED signage displays does not even reach 1,000. In the field of microdisplays, the numbers are also relatively small so far (and there's only one microdisplay display product that ships commercially), although it seems as if there is a growing market for small, high brightness, high efficiency monochrome displays in China for low-cost AR HMDs, mostly used for biking and bicycling navigation.

Some companies in the smartwatch space have already declared commercial production capabilities, but in fact these displays are not yet adopted in commercial products, there is no actual smartwatch product on the market that uses MicroLED displays. It is likely, though, that the launch of the world's first microLED is imminent, likely before the end of 2025, but these will be luxury / high-premium smartwatch devices, produced in low volumes.

The industry, however, does not seem to lose hope because of these low numbers. The display industry is a large one, estimated at tens of billions of dollars per year, which produces billions of panels annually. Historically, every new technology has taken a long time to mature, and it is not a surprise that MicroLED technology is no exception.

Following is a table that summarizes the current status of the industry.

	Microdisplays	Tiled modules (TVs)	Wearables	Automotive displays	Transparent microLEDs	pmULEDs	Monitors	Tablets and Laptops	Smartphones
Number of active microLED developers	18	16	8	7	6	3	1	2	0



The chart shows that, in line with technology maturity level and relevant markets, the areas closest to production are:

* Smartwatch and other wearables
* Microdisplays, mostly for the AR market
* Large area tiled displays
* Automotive displays
* Transparent displays

Many companies also highlight transparent displays. It is an interesting segment with a major advantage for MicroLEDs over OLEDs (level of transparency). The main problem in this market segment remains the fact that there's no actual market demand or use case for a large number of displays. It seems as if many microLED developers are betting that the added performance of microLEDs will unlock an actual viable market.

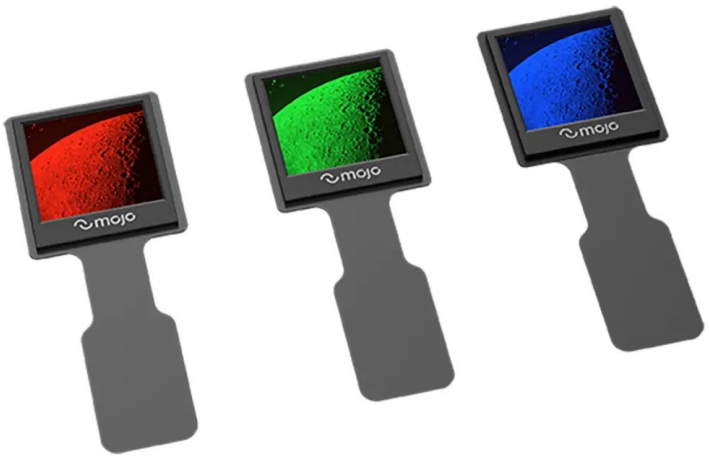
Microdisplays

This segment of the display industry is attractive for microLED displays:

- Microdisplays applications (mostly for AR/VR HMDs, HUDs) benefit very much from high performance displays (especially high efficiency and high brightness)
- Manufacturers agree to pay a premium price for best-in-class performance
- Manufacturing MicroLED microdisplays is actually easier than larger displays [4]
- The market is still emerging and is relatively small compared to other display industry segments, which could make it easier to penetrate with new technology.

Many companies are developing such displays, but only one company commercially produces MicroLED microdisplays. Note that these are monochrome displays of a very small size (0.13 inch). While this is a humble start, there is great market interest in MicroLED solutions and we expect more manufacturers to start offering such displays, with selection and performance improving quickly.

Both early-stage companies and consumer electronics leaders are developing microLED microdisplay solutions for AR. Meta for example uses microLEDs in its Orion project, and Google's Raxium is developing its own microLED microdisplays. These are excellent indicators and a place for optimism for the industry.



Smartwatches and wearables

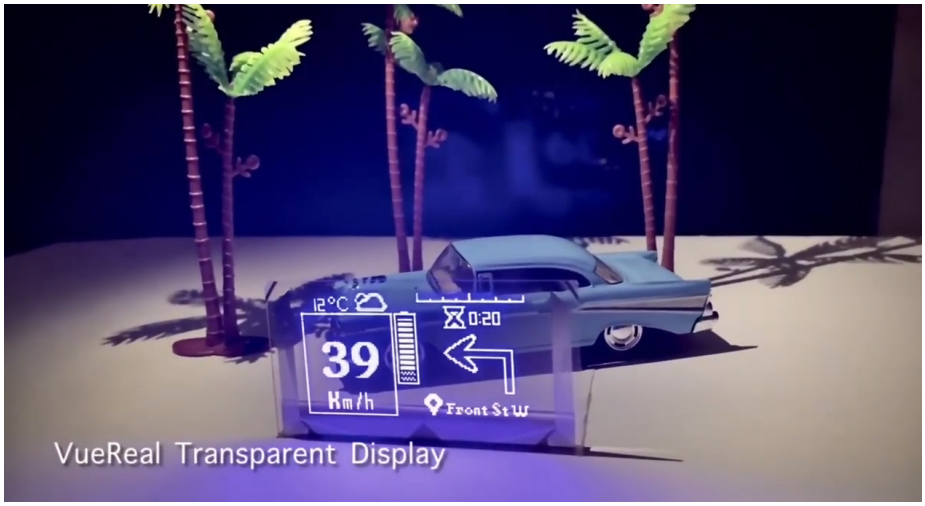
Several microLED developers target the wearables market as these devices use relatively small and low-resolution displays, making them easier to produce. Power efficiency is also highly important, as is display brightness, two areas where microLEDs excel.

AUO has already declared that it has started the commercial production of wearable microLED displays, and we expect the first product announcement to arrive in early 2025. This is low-scale production of high-end displays that will carry a large premium in cost, thus only suitable for premium products. We expect several more companies to start producing microLED wearable displays in the near future, also in low capacity fabs.

In early 2024, Apple decided to cancel its own microLED wearable project [8]. This was not a surprise as the company's target of replacing the OLED display of its mainstream watch with a comparable-in-cost microLED was too ambitious a project. We believe that microLEDs are not ready to compete with AMOLEDs in price in this segment yet. Companies are looking to employ novel technologies, one such example is Applied Material's process which is based on UV LEDs and full color conversion, which the company touts as a platform for the production of microLED wearable displays.

Automotive displays

The automotive market is an interesting one for MicroLED manufacturers. It demands high performance and adopts new technologies relatively quickly. In addition, OLEDs are not ideal for this market due to requirements like long lifetime and operation in a high temperature range. This gives MicroLED displays the opportunity to enter this space and there are indeed many companies that develop automotive displays, and in the past year we have seen many microLED automotive display prototypes on display at tradeshows.



It should be noted that the automotive industry uses increasingly large displays, and luxury cars already use 12-inch (and over) display, including ultra-large displays of 30-50 inch, made by joining together several displays. Sizes like that are still challenging for commercial manufacture of MicroLEDs. This segment may take years to mature. However, it is also important to understand that many cars also adopt smaller displays, in a large array of use cases, like HVAC displays digital mirrors (usually around 7-inch displays), HUD displays (that require microdisplays, note), and more. These may also offer opportunities for microLED developers.

Note that the unique ability of microLEDs to enable tiled displays could prove useful in automotive applications, as companies could produce standard modules and automotive display designers can create custom shaped displays. It remains to be seen whether this is a viable route, though.

Large-area displays

Large displays based on MicroLEDs have been around for years, by several companies including LG and Samsung. These companies turned to markets like high-end signage or ultra-premium residential displays, offering MicroLED TVs at extremely high prices, sometimes reaching several hundreds of thousands of dollars per unit.

At this price level, the number of units sold annually is very small – so while this whole market is limited and far from mass production, companies find it possible to offer these screens as actual commercial products. Companies are also increasing the number of models, reducing the display size (to more 'consumer-levels') and prices are slowly being reduced.

Although the TV market saw the introduction of microLED TVs years ago, there doesn't seem to be a clear path to lower the price of these displays enough to compete with LCDs and OLEDs when it comes to standard (or even premium) consumer TV market sizes, which are about 30-90 inches. It will take years for MicroLED production technologies to mature enough to allow competitive presence in the TV market. [5]

Note that all large-area microLED production today adopts a seamlessly tiled display architecture. Tiled displays offer advantages in scalability to very large size, compared to LCD and OLED production which is performed on large substrates. It is not clear whether tiled display architecture will ever be applicable to consumer TV applications. [6]

Transparent displays

Transparent displays are very interesting and have been researched for many years - and we have seen commercial adoption of transparent LCD, LED and OLED displays. These never achieved meaningful market success, mostly due to lack of demand and relatively high prices.

MicroLED technology can realize excellent transparent displays, as they combine high brightness with high transparency (as the small aperture ratio of microLEDs enables more light to pass through the display compared to other display technologies). Many MicroLED developers thus believe and hope that once microLED transparent displays are available commercially, market demand will follow, and it will kickstart a meaningful transparent display market.

In recent years, we have seen many display makers demonstrate transparent microLED prototypes. There has been some initial market deployment [7] but this is not yet commercial production.

MicroLED Market Roadmap, 2025-2034

Market Segment	Short term 2025-2026	Medium term 2027-2030	Long term 2031-2035
MicroLED Microdisplays	Simple monochrome displays enter the market	Full-color displays enter the market, prices still high, niche applications	Mass production and adoption of full color microLED microdisplays
Passive-Matrix microLEDs	First pmULED displays enter the market	Wider range of displays in production, prices still high	pmULED compete with pmOLED, wider production and adoption
Wearables	Pilot-level production of wearable amULED for Ultra-premium wearables	Full scale production, initial adoption in premium products	Full scale production, initial adoption in products
Smartphones	—	—	Initial R&D efforts, pilot level production
IT (tablets/ laptops/monitors)	—	Initial R&D efforts	Pilot level production, initial premium product adoption
Consumer TVs	—	—	Initial R&D efforts, pilot level production
Signage and ultra-large TVs (tiled)	Pilot-level production, ultra premium product adoption	Lower production cost, increased production capacity, still ultra-premium devices only	Lowering production cost, increased adoption, but volume remains low
Automotive displays	R&D, prototypes	Initial pilot-level production, adoption in high-end models	Increased production capacity and adoption
Transparent displays	R&D, prototypes	R&D and prototypes, initial market deployment	Initial pilot-level production, looking for applications

MicroLED industry technical roadmaps, 2025-2033

MicroLED Market Advantages

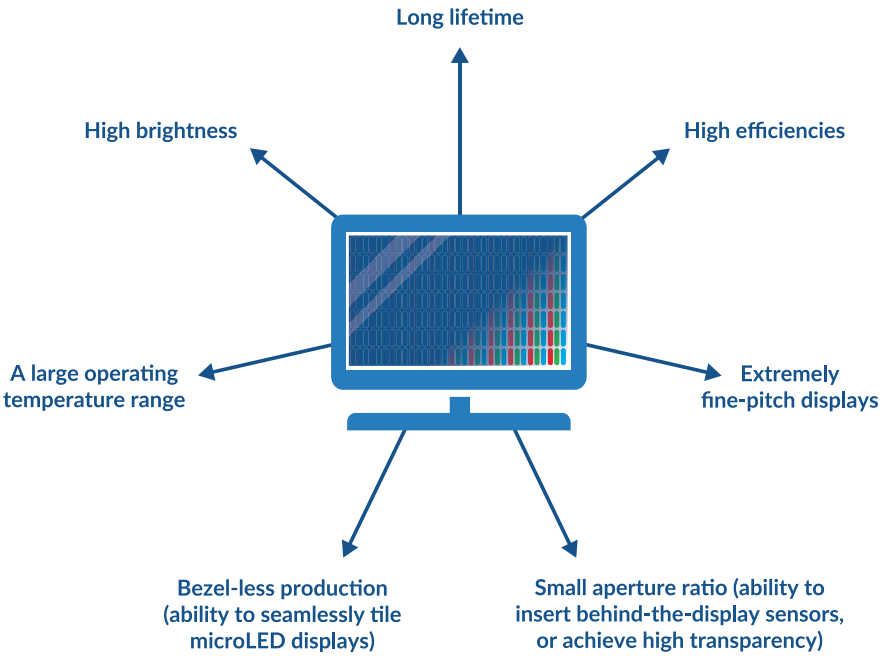
The microLED industry faces a difficult challenge of finding its place in an industry with very strong existing display technologies. LCD and OLED displays today achieve very high performance, excellent image quality and low production costs at very high capacities. The ability to produce displays inline on large substates has resulted in very low cost of production, without sacrificing the image quality or performance.

This is the status of the market that microLEDs currently face, and it is likely that as time progresses, the production cost of OLED displays will continue to decrease, while performance will continue to increase (driven by the adoption of technologies such as tandem architectures, high-efficiency blue emitters, maskless production, MLA, plasmon OLEDs and more).

In such an environment, it is vital for microLED developers to make sure the advantages of microLED displays are distinct and that these are **not compromised by the choice of production processes or display architectures**.

The following list summarizes the major advantages of microLED displays:

* High brightness
* High efficiencies
* Long lifetime
* A large operating temperature range
* Small aperture ratio (ability to insert behind-the-display sensors, or achieve high transparency)
* Bezel-less production (ability to seamlessly tile microLED displays)
* Extremely fine-pitch displays



It is likely that as the first step, the market will adopt microLEDs in applications that especially benefit from these advantages, and that have the ability to use premium displays at premium prices. We identify automotive displays and AR displays as the two key markets at this stage.

Footnotes

[1] The number of challenges in the MicroLED market is substantial: improving LED production yields, choosing an efficient and suitable transfer technology, manufacturing extremely small LEDs that remain efficient, developing native red LEDs or using color conversion in a way that allows efficient manufacturing, and more.

[2] There are several architecture levels in MicroLED display production. At the single LED level, there is a choice between blue or UV LEDs while using color conversion, Nanowire LEDs, tunable LEDs and more. At the backplane level, there are TFT solutions like the ones used in LCD and OLEDs or solutions like MicroICs and Smartpixels. Another factor is whether the display is made of a single unit or a seamlessly tiled module, etc.

[3] Market projections are always hard to put together reliably, and they almost always miss the mark. However, it seems that the MicroLED industry is at such a preliminary stage that it not only has 'known unknowns' like "when will production start" and "will adequate technologies be developed in time", but there are also 'unknown unknowns' which are likely to catch the industry by surprise. These could (hopefully) be new technologies that would address today's major challenges, which should allow for significant advancements to follow.

[4] Small displays (generally under 2 inches, often even smaller than 0.5 inch) can be manufactured without a transfer process, through what is known as a "monolithic process". More information on this matter can be found in the Monolithic Processes White Paper by the MicroLED Industry Association.

[5] More information on this subject can be found in the MicroLED Yields – and Strategies to Overcome Them white paper, by the MicroLED Industry Association (https://www.microledassociation.com/downloads/).

[6] More information on this subject can be found in the MicroLED Tiled Displays – Current Status and Roadmap white paper, by the MicroLED Industry Association (https://www.microledassociation.com/downloads/). Note that there is innovation though in this segment that could change the potential of such displays. For example AUO is looking into adopting very large tiles, it recently demonstrated how three 31-inch tiles can form a 54-inch display. The company believes a small amount of panels will result in reduced costs.

[7] A notable example is AUO's deployment, in collaboration with ITRI, of 17.3" 120Hz 1820x720 transparent (55% transmittance) microLED displays on a ferry line in Taiwan. The gesture-controlled AI smart window screen navigation system combines AR and eye tracking to show tourists information based on what they are looking at.

[8] In March 2023, ams-Osram announced that its main microLED customer (Apple) canceled its project, and the company will incur impairment charges of $650-$900 million and realign its strategy going forward. Other companies, including KLA and Kulicke & Soffa also canceled their own projects with Apple.

Member Directory

#Lasers, #production equipment, #Mass transfer, #inspection & repair

3D-Micromac

Laser equipment for µLED forward transfer, lift-off and repair process steps - ready for high volume production

Germany-based 3D-Micromac AG is the industry leader in laser micromachining and roll-to-roll laser systems. The company develops and manufactures processes and laser systems delivering powerful, user-friendly and leading-edge processes with superior production efficiency.

3D-Micromac systems and services have been successfully implemented in various high-tech industries worldwide. This includes semiconductor, photovoltaic, glass and display industry, electronics, as well as medical device technology.

For microLED display manufacturing, 3D-Micromac offers industrial laser solutions for mass production:

- Laser-Induced Forward Transfer (LIFT) which enables the transfer of hundreds of millions of microLEDs without having to apply mechanical forces
- Laser Lift-Off (LLO) which guarantees a highly uniform, force-free lift-off of different layers on wafer and panel substrates
- REPAIR: Single die repair process at every step of the microLED production process

https://3d-micromac.com/

#microdisplays, #LED epiwafers

ALEDIA

Aledia is a start-up company established in 2021 in the Grenoble area (France) to develop GaN nanostructure-based LEDs for Display applications. It has 220 people (30% PhDs), has more than 250 patent families granted or in application, and has raised €270M in four financing rounds.

Aledia has two nanowire LED platforms, one based on blue GaN nanowires on 8-inch wafers, and the second that utilizes RGB LEDs. The company targets a wide range of markets, from AR microdisplays to TVs and videowalls.

Aledia has built a factory near Grenoble (France) for high volume epitaxial growth and low volume LED processing manufacturing; high-volume manufacturing capacity is being implemented in different countries including in Asia, closer to the market.

https://www.aledia.com/

#materials & technologies, #LED epiwafers

ALLOS Semiconductors

GaN on Silicon IP licensing and technology

ALLOS Semiconductors is an IP licensing and technology company that focuses on GaN-on-Si technology.

For the micro-LED market, ALLOS offers a turn-key technology transfer to establish a super-uniform CMOS-compatible large (200 mm) epiwafer process at customers within only 12 weeks.

https://www.allos-semiconductors.com

#LED epiwafers

ams-OSRAM

In an increasingly connected world, sensing is taking a crucial role by closing the gap between the physical and the digital. Using the full spectrum of light we allow humans and machines to capture and understand the world around us. Combining sensors, software and emitters, we bring the information that our environment holds to light by capturing, analyzing and visualizing it. We sense the world and make sense of it.

https://ams-osram.com

#production equipment | mass transfer
#inspection & repair

Applied Materials

Applied Materials is a world leader in materials engineering solutions used to produce semiconductors and advanced displays. The company offers a wide range of equipment for the production and testing of displays.

For the microLED industry, Applied Materials develops a complete mass transfer, inspection and repair process. The company also offers its own display architecture based on UV LEDs and QD color conversion.

https://www.appliedmaterials.com/

#MicroLED research

CEA Leti

One of the world's largest microelectronics and nanotechnology organizations

CEA-Leti is a non-profit research institute based in Grenoble, France. CEA-Leti is one of the world's largest microelectronics and nanotechnology organizations.

Leti is developing micro LED displays, with a focus on high-performance microdisplays. Leti has implemented this LED technology to manufacture high-brightness uLED arrays hybridized on silicon circuit with a 10-um pixel pitch and the institute manufactures blue and green arrays offering a brightness of 107 cd/m².

http://www.cea.fr/english

#Lasers, #production equipment,
#mass transfer

Coherent

Laser-based solutions for the microLED industry: from a single laser source up to LLO, LIFT and repair systems

Coherent makes the amazing possible using the power of light. Performance, quality, and a global expert network support our customers in scientific, medical, electronics, and manufacturing markets.

MicroLEDs represents an exciting opportunity, potentially lowering the costs for very large area displays as well as some small area display applications. High energy, ultraviolet lasers are the key to success to cut production costs, increase throughput, and improve quality. Coherent provides several solutions from a single laser source, optical systems up to an integrated system for the three vital processes in MicroLED fabrication: Laser Lift-Off (LLO), Laser-Induced Forward Transfer (LIFT), and Repair/Trimming. Coherent also covers more process steps of the entire MicroLED production chain from laser cutting by ultrashort pulse lasers to Laser Assisted Bonding (LAB) by diode lasers.

http://www.coherent.com/

#materials & technologies, #LED epiwafers

Comptek Solutions

Develops quantum technology that boosts the performance of devices such as microLEDs and lasers

Founded in 2017 as a spin-off from the university of Turku, Finland, Comptek Solutions develops quantum technology (branded as Kontrox) that boosts the performance of devices such as microLEDs and lasers and makes their manufacturing process easier by solving the problem of aggressive oxidation of compound semiconductor materials.

Kontrox results in a high-quality passivation layer with substantially reduced defect densities that help to greatly decrease the surface recombination phenomena which is a predominant mechanism for such small devices.

Comptek says that MicroLED efficiencies increase significantly with Kontrox, the company has demonstrated up to 250% EQE (external quantum efficiency) improvements.

http://www.comptek-solutions.com

#materials & technologies

Corning

Corning develops and produces specialty glass, ceramics, and related materials and technologies including advanced optics, primarily for industrial and scientific applications. For the display industry, Corning supplies both rigid and flexible glass substrates, glass carriers and cover glass.

Together with its customers, Corning evaluates opportunities in the microLED industry, where a glass solution aligns with its deep materials science expertise.

https://www.corning.com/

#materials & technologies

DELO

DELO is a leading manufacturer of high-tech adhesives and other multifunctional materials as well as corresponding dispensing and curing equipment. Their products are mainly used in the automotive, consumer electronics and semiconductor industries. They can be found in almost every mobile phone and half the cars worldwide, for example in cameras, loudspeakers, electric motors, or sensors. Customers include Bosch, Daimler, Huawei, Osram, Siemens, and Sony. The company has 1,000 employees and achieved revenues of €204 million in fiscal 2023.

Additionally, adhesives facilitate miniaturization, increase performance, and improve device functionality and reliability, from tiniest SMD component like miniLED and microLED to large size edge sealing.

https://www.delo-adhesives.com

#mass transfer

eLux

Massively parallel fluidic assembly of microLED displays

eLux Inc. was established in 2016 in the USA as a spin-out from Sharp Labs of America. eLux expertise and intellectual property development focus on the massively parallel assembly processes that enable low cost manufacturing of microLED displays.

https://www.eluxdisplay.com/

#materials & technologies, #microdisplays, #MicroLED Research

Fraunhofer FEP

Electron beam technologies, vacuum thin film deposition techniques and technologies for organic electronics, microdisplay technology and sensorics.

The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP is one out of 76 institutes and research units of the Fraunhofer-Gesellschaft e. V., the largest European institution for applied research. The core competences of Fraunhofer FEP are electron beam technologies, vacuum thin film deposition techniques and technologies for organic electronics, microdisplay technology and sensorics. Main activities target development and adaption of the thin film deposition technologies to a wide range of industrial applications. Fraunhofer FEP runs multiple pilot scale vacuum coating systems.

Furthermore, Fraunhofer FEP has a unique position in designing microelectronic circuits and components with application- and customer-specific adaptations of silicon circuit foundries' CMOS processes that allow these finished wafers to be subsequently processed with OLED coatings, for example. This subsequent processing is used in particular for augmenting silicon CMOS wafer functionality with optical and photonic components, such as for high-resolution OLED microdisplays.

https://www.fep.fraunhofer.de/en.html

#materials & technologies, #MicroLED Research

Fraunhofer IZM

One of the world's leading institutes for applied research and the development and system integration of robust and reliable electronics

For 30 years, more than 440 employees have been finding technological solutions in cooperation with partners from industry and academia. Emerging challenges are addressed in branches such as automotive and industrial electronics, medical engineering, ICT and semiconductor technology.

Our technologies connect the individual components, protect components and devices from vibration and moisture, and reliably dissipate heat. Fraunhofer IZM thus ensures that electronic devices continue to function reliably in even the harshest conditions. Modern packaging technologies make developing smaller and smaller products possible. We process ICs thinner than a sheet of paper. The institute, founded in 1993, disposes of a lab area of over 8,000 sqm. About 80 percent of our turnover in 2021 was earned through contract research.

https://www.izm.fraunhofer.de/en.html

#color conversion

General Electric

For more than 125 years, GE has invented the future of industry. Today, GE is best known for its work in the Power, Renewable Energy, Aviation and Healthcare industries.

GE's Licensing team provides access to GE's patent portfolio and technical and intellectual resources. Licensees receive world-leading technology paired with advice and guidance to accelerate their technology development and achieve market differentiation.

The GE LED Phosphors team has world class chemistry and physics expertise as well characterization capabilities that have resulted in commercial successes in both lighting and LCD display technologies. Multimillion-dollar yearly revenue, multiple awards, hundreds of patents, over 20 licensees of our patents, along with various publications and invited conference presentations show that this team is on the cutting edge of luminescent material development and can advance from concept to invention to commercialization.

https://www.ge.com

#inspection & repair

InZiv

Testing and inspection tools for the microLED industry.

InZiv provides testing and inspection tools for the microLED industry. InZiv's technology offers one comprehensive platform for both full wafer mapping and individual chip testing and characterization at the highest resolution. Automated PL and EL provide today's most critical measurements, including EQE and angular measurements, and Nano-PL and Nano-EL enable the user to zoom in on individual chips and sub-pixel features and defects with 100nm resolution.

InZiv integrates multiple inspection modalities in one system, and provides a comprehensive analysis of both the whole wafer and its sub-pixel features. This unique combination empowers microLED developers and manufacturers with the ability to better understand the relationship between light, color, current, and structure – directly addressing today's most critical challenges in microLED.

https://inziv.com/

#materials & technologies

Innovation Semiconductor

Developer of unique, monocrystalline-material microLED system architecture

Innovation Semiconductor has developed novel technologies to facilitate higher yield fabrication of microLEDs and microLED displays of improved performance. The company's patented and patent pending advances enable monolithic fabrication of LEDs and transistors without mass LED transfer, color-tunable LEDs based on novel architectures that support high efficiency, and high-speed connectivity options.

https://www.innovationsemi.com/

#inspection & repair

Instrument Systems

Develops and produces high-end light measurement technology, (AR/VR) displays, mLED wafers, VCSEL/laser systems, automotive lighting and LED/SSL modules.

Instrument Systems GmbH, founded in Munich in 1986, develops and produces high-end light measurement technology that is indispensable for the manufacturers of consumer electronics, (AR/VR) displays, mLED wafers, VCSEL/ laser systems, automotive lighting and LED/SSL modules. All solutions benefit from our CAS series of high-precision spectroradiometers that are recognized and in use all over the world. In combination with 2D imaging colorimeters, integrating spheres and goniometer systems, they enable high-precision and accurate measurements in the entire range from UV to IR, traceable to PTB or NIST.

Today, Instrument Systems is one of the world's leading manufacturers of light measurement technology. At its Berlin facility, the "Optronik Line" of products is developed and marketed for the automotive industry and traffic technology. Our subsidiary in Korea supplements the product portfolio with the "Kimsoptec Line" for the Korean light & display market.

Instrument Systems has been a wholly-owned subsidiary of the Konica MinoIta Group since 2012.

https://www.instrumentsystems.com/en/

#microLED displays

LG Electronics

The LG Business Solutions Company is a trusted partner offering innovative products and solutions for diverse industries worldwide.

With a portfolio of unique offerings, such as industry-leading OLED signage, LED signage and commercial TVs, LG is a respected name among customers around the world.
For more on LG's Business Solutions, visit www.LG.com/b2b

https://www.lg.com/global/business

#color conversion

Mitsui Kinzoku

Produces functional engineered materials and electronic materials, nonferrous metal smelting.

Japan-based Mitsui Mining & Smelting (also known as Mitsui Kinzoku) produces functional engineered materials and electronic materials, nonferrous metal smelting, minerals resource development, precious metal recycling, raw material related businesses, manufacturing and sale of automotive parts/components, etc.

For the MicroLED Industry, Mitsui Kinzoku developed a sulfide phosphor for color conversion. The material is highly durable and does not contain any hazardous material. As of 2023, the company is sampling the material for microLED developers.

https://www.mitsui-kinzoku.co.jp/mlab/en/

#Materials & Technologies

Mojo Vision

Developing RGB Micro-LED displays

The Future of Micro-LED Technology is Here

Mojo Vision is focused on developing and commercializing world-class micro-LED technology for consumer, enterprise, and government applications. Developed as a critical component of Mojo Lens and first announced in 2019, the Mojo Vision Micro-LED Display is the smallest, densest dynamic display ever made, and the Micro-LED technology platform underlying it is powerful and flexible enough to serve a wide range of applications from next generation wearables all the way up to future televisions and video walls. We believe Micro-LED will disrupt the entire $160B display industry and our unique technology puts us at the forefront of this disruption.

https://www.mojo.vision/

#display drivers

nsc innovation

Monolithically integrating GaN LEDs with silicon CMOS to enable microdisplay solutions

nsc is a groundbreaking integrated circuit design company based out of Singapore. Our chips are the first to effectively integrate silicon CMOS with GaN LEDs monolithically and at full wafer scale, while maintaining compatibility with traditional CMOS manufacturing. By doing so, nsc offers the functionality and manufacturability needed to enable widespread adoption of microdisplays. These highly efficient and cost-effective LED pixelated light engine (PLE™) chips can serve as the backbone for displays that will change the form factor of wearables, increase battery life, decrease cost, and make possible game-changing new product innovations. Our integrated chips are produced by co-opting existing manufacturing equipment and processes in order to deliver them at commercial scale.

https://www.nscinnovation.com

#Color conversion

QNA Technology

Quantum dots for the display industry, based on unique surface engineering and QD inks

Poland-based QNA Technology, established in 2016, develops and produces quantum dots for the display industry.
The company optimizes its QDs for two applications: electroluminescence display devices (QD-EL) and for microLED displays devices based on UV microLEDs.

QNA developed QD surface engineering to enable the delivery of its materials in various solvents, such as polar, non-polar, monomers, powders, and more. The company is also developing QD inks for ink-jet printing and for UV-curable inks.

https://qnatechnology.com/en/

#Color conversion

Qustomdot

Cadmium-free quantum dots technology for microLED displays

Belgium-based QustomDot brings unmatched colors through quantum dot (QD) color conversion to microLED applications. The team combines QD synthesis, surface engineering and ink/photoresist formulation into patterned color conversion layers for microLED displays. QustomDot's patented technology is cadmium free and can withstand high light intensities.

https://www.qustomdot.com

#Materials & Technologies

Radiant Vision Systems

Automated inspection systems for microLED displays

US-based based Radiant Vision Systems, a Konica Minolta company, provides advanced imaging systems to critically evaluate light, color, manufacturing integrity, and surface quality of illuminated displays and device assemblies.

Radiant offers fully customized and automated inspection systems for microLED development and production.

https://www.radiantvisionsystems.com

#Materials & Technologies

Smartkem

Seeking to reshape the world of electronics with a revolutionary semiconductor platform that enables the next generation of low-cost displays and sensors.

SmartKem's patented TRUFLEX® inks are solution deposited at a low temperature, on low-cost substrates to make organic thin-film transistor (OTFT) circuits. The company's semiconductor platform can be used in a number of applications including mini- and micro-LED displays, AMOLED displays, AR and VR headsets, fingerprint sensors and integrated logic circuits. SmartKem develops its materials at its research and development facility in Manchester, UK, and its semiconductor manufacturing processes at the Centre for Process Innovation (CPI) at Sedgefield, UK. The company has an extensive IP portfolio including over 124 issued patents across 19 patent families.

https://www.smartkem.com

#MicroLED research, #LED epiwafers

Solid State Lighting & Energy Electronics Center

Researchers to advance solid-state lighting and energy efficient power switching using wide-bandgap semiconductors.

The Solid State Lighting & Energy Electronics Center (SSLEEC) at UC Santa Barbara is a collaborative center, which partners key industry leaders and UCSB researchers to advance solid-state lighting and energy efficient power switching using wide-bandgap semiconductors.

SSLEEC is focused on new semiconductor based technologies for disinfection, advanced mobile displays, energy efficient lighting, and power electronics. The objective of the SSLEEC is to provide a forum for its members – key industry partners and the faculty and student researchers at the University of California, Santa Barbara – to work in collaboration and across scientific disciplines to address the most challenging problems in these important and timely areas of research.

https://ssleec.ucsb.edu

#microLED displays

STRATACACHE

Digital signage systems developer, microLED display producer

STRATACACHE is a digital signage, merchandising and customer engagement systems developer, targeting the retail, restaurants, banking and financing, gaming, events and education markets.

STRATACACHE is constructing the first US-based complete display production facility in Eugene, Oregon, the future MicroLED E4 fab.

https://www.stratacache.com/en/

#production equipment

Tokyo Electron (TEL)

Global semiconductors production equipment maker

Tokyo Electron Limited (TEL) is a Japanese electronics and semiconductor company headquartered Tokyo, established in 1963. TEL supplies equipment to fabricate ICs, photovoltaic cells and flat panel displays. TEL is considered to be the world's largest manufacturer of IC and FPD production equipment.

https://www.tel.com

#Mass transfer, #materials & technologies

Terecircuits corporation

Photo-polymer mass transfer system for microLED production

Terecircuits develops technologies and manufacturing processes for microassembly based on a new class of photo-chemical polymers.

The company focuses on the development of a microLED photo-chemical mass transfer process.

http://terecircuits.com/

#microLED displays, #mass transfer, #microdisplays

Vuereal

Micro-LED display technologies and display production

Canada-based VueReal is a startup company that develops Micro-LED display technologies. VueReal developed a cartridge-based microLED printing process that can produce high density displays at high production yields.

In addition to microLED technologies, VueReal also produces microLED displays, and offers custom display production done at its pilot production line in Waterloo, Canada.

https://www.vuereal.com

#inspection & repair

WEVE

World-class inspection of Epi Wafers, Micro LED CoWs, and OLED

WEVE is a South Korea-based company with industry-leading expertise in Epi wafer and CoW inspections. We are trusted by world-leading display and wafer manufacturers in South Korea and Taiwan. Our contactless and nondestructive technology performs AOI, PL, and Color Difference (xyY, WD) analysis in a single run. Conducting such a complex analysis is meaningless if inspection time greatly exceeds the realities of mass production. We provide crucial data set under acceptable time 6-inch CoW – under 10 minutes, 6-inch Epi Wafer – under 12 minutes. Being involved in big-scale productions we have accumulated great experience that helps our technology to be extremely useful in real environments. WEVE is among the very few in the world in terms of the total number of wafers inspected. We are always open to partnerships and new business development.

https://en.theweve.com