

## PixCell LED

Ultimate precision in perfect alignment

100+ individual cells with just 25 µm spacing, perfectly matrixed onto a single LED chip for intelligent headlamps



# Editorial

## Innovation, Team Spirit At AMLS *By Gerd Bahnmüller, DVN Advisor*

It was a wonderful sunny spring day when I drove to Regensburg to visit and interview the AMLS people—that's AMS Osram's vehicle lighting team. AMLS became an independent entity under the umbrella and ownership of AMS Osram in October 2021, having been founded in July 2018 as a 50/50 joint venture between Osram and Continental before being reintegrated into the respective parent companies. Only two days after my visit, AMS Osram announced the sale of AMLS to Plastic Omnium. Having a complementary product portfolio, the two companies expect to jointly expand their market access and to establish a strong mobility lighting player built on AMLS' portfolio of innovative technologies.

Headquartered in Munich, AMLS combine lighting technology with electronics and software to develop intelligent, innovative lighting solutions for the automotive industry. They employ about 800 people across five R&D sites (including US and China) and three production sites. The product portfolio includes projection solutions; front, interior, body shell, and signal lighting; and LED driver modules. Despite the multiple changes in company ownership, the team radiate a refreshing dynamism and enthusiasm. This team spirit and the short decision-making paths are the ideal recipe for reacting quickly and flexibly to market trends and creating targeted, innovative products. During my visit and our discussion, I had the opportunity to see some of the recently developed prototypes and products in action. A selection of these are described in this week's in-depth article.

AMLS focus strongly on projection—static, dynamic, and digital—outside and inside the vehicle. The creative team also develop a variety of smart products in other areas, including the likes of standard-modularised replaceable LED light sources; LED projection modules, and elegant backlit touch control panels. Through partnerships with other companies, expertise in intelligent lighting is combined with exterior components; plastics processing, and injection molding. In this environment and with the enthusiasm I have experienced, I am very sure we will see a lot of new and innovative products from the AMLS team. Let's be surprised!



GERD BAHNMUELLER, DVN ADVISOR  
FORMER R&D DIRECTOR, MARELLI AUTOMOTIVE LIGHTING

# In Depth Lighting Technology

## AMLS: "A Tier-1.5 Supplier"



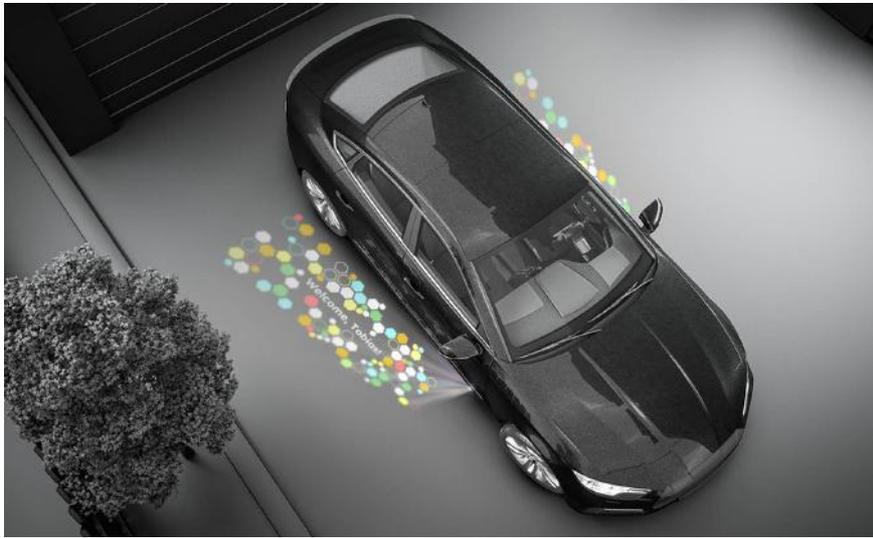
L-R: HUBER · ROSENAUER · BAHNMUELLER · BRUHN · GAERDITZ

DVN had the opportunity to interview Dr. Michael Rosenauer (head of projection R&D); Karen Bruhn (head of EMEA); Tobias Huber (advanced development team lead), and Dr. Christoph Gaerditz (head of interior lighting) at AMLS' R&D site in Regensburg.

**DVN: After a turbulent few years of founding and building the company under the impact of the pandemic, what makes you confident of success in the years ahead?**

**Karen Bruhn:** First of all, the exceptional spirit of the team. Everyone is committed to the success of the company with their skills. With the establishment of the joint venture between Osram and Continental in 2018, people have been brought together who now combine their knowledge in the fields of optics, lighting electronics and software. We have abolished hierarchical structures and processes, and introduced goal-oriented team structures with short decision-making paths. This powerful organization and our profound know-how are the basis for the success of our products. We try to identify market trends at an early stage and derive opportunities for new products from them.

Another point is our diversified product portfolio, which covers many applications inside and outside the car. As a result, we are successful in very different regions. For example, business with LED modules for headlights tends to focus on America and China, while in Europe our expertise in interior and exterior projections is in demand.



**DVN: At the beginning of 2018, established tier-1 lighting suppliers saw your company as a threat. Where do you currently see your position in the market and on which products do you focus?**

**MR:** We see our position as a tier-1.5 supplier. Worldwide, we have many direct relationships with automakers. In the US and China, for example, we are also in close contact with tier-1s and supply them. We have a strong focus on developing projection systems. Light projection extends the capabilities of traditional headlight technology and transforms the vehicle and its environment into a canvas for automakers and mobility providers. We see an increased interest in our projection solutions for both exterior and interior applications. In the past, we have experienced how fundamentally lighting solutions can evolve: What used to be limited to two spotlights that could be switched on and off manually is now an intelligent system of more than a million individually-controllable LED light points. These technological developments open up numerous possibilities for new functionalities and a new design.



**DVN: How do you see the current state of projection inside and outside the car, and what will happen in the next few years?**

**TH:** We divide projection into static, dynamic, and digital applications. Static projections are already state of the art in many cars, e.g., in the form of an exterior light carpet when the door is opened. The next level is dynamic functions by overlapping, segmenting and/or flashing multiple static patterns. Digital projections offer maximum flexibility and virtually no limits in terms of the projected image. They support the trend towards personalisation tailored to end-user preferences, and offer automakers the opportunity to implement features on demand. Our digital projection systems, for example, offer drivers a wide range of options for displaying customised content from static motifs and patterns to dynamic video, both inside and outside the vehicle. The systems are based on DMD modules which—thanks to their compact design

—can be installed very flexibly in or on the vehicle to display projections on a wide variety of surfaces.



**DVN: You mentioned collaboration with other interior technology companies. Who are you working with and on what applications?**

**CD:** We recently announced a partnership with Grupo Antolin to further develop and integrate our digital projection solutions for vehicle interiors. Together we are working on new features, such as projections on the headliner, to provide passengers with a new experience and more comfort while driving. We are also working with thin-film technology company KURZ, with whom we have developed a new overhead light console that combines advanced interior lighting functions such as matrix reading lights and symbol projections with a unique shytech design. We are continuously expanding the range of applications for our interior lighting solutions. When designing our products, we place particular emphasis on compact dimensions, high system efficiency and optimum connectivity.



**DVN: The automotive industry is currently moving strongly in the direction of electric, connected, and driver-assisted vehicles: How does this change affect your company?**

**MR:** For us, the rapid development of electromobility goes hand in hand with connected lighting solutions. Halogen and xenon lamps have been replaced by intelligent lighting systems connected to onboard sensors and external data sources, offering new possibilities for interior and exterior lighting. The result are solutions that combine light with electronics, improve system efficiency and support the driver with high-definition lighting. Another trend that is being boosted by electromobility: Body shell lighting. The elimination of the engine and its necessary cooling system opens up new possibilities for bumper design. Body shell lighting will play a significant role here. By merging light with the vehicle surface and its add-on parts, the vehicle's shell becomes a stylish visual element that supplements existing functions or takes on functions of its own. All in all, the development towards electromobility offers us an excellent playground to create new ideas and further develop intelligent and innovative solutions.

# Lighting News

## Varroc looking to sell global lighting business for up to €600 million

LIGHTING NEWS



“Varroc Engineering, an auto component maker promoted by Tarang Jain, is likely to sell its global lighting business Varroc Lighting System (VLS) at an enterprise value of up to €600 million to a leading European component maker to pare its debt, multiple people aware of development told ET.

## THE ECONOMIC TIMES | Industry

“The company has brought on board a European investment bank based in Paris a few months ago to look for buyers for its global lighting business where it makes head lamp, rear lamps, and fog lamps, added people in the know.

“The sale exercise is currently undergoing a due diligence process with European component makers. It has annual revenue potential of more than €6 billion,” said a person familiar with the development. After the deal, Varroc is likely to become debt free. VLS is the sixth largest automotive lighting maker globally, supplying parts to Ford and JLR

Varroc Lighting Systems has 12 operating facilities for passenger cars in the Czech Republic, China, India, Mexico, Morocco, Turkey, Poland, Brazil and Romania, and two facilities in two-wheelers.

# Hella's New Front End Design Concepts

## LIGHTING NEWS



An electric car has no engine, so it needs no radiator, so it needs no radiator grille, and that frees up the front of the car to be designed in ways impossible before. Hella are developing large panels for this purpose, with careful attention to both design and functional integration.

Front radar covers ("radomes"); radar and lidar sensors; cameras, and headlamps are all integrated into the new front panels. Hella's lighting managing director Dr. Frank Huber says "We act as an innovative system integrator. Vehicle manufacturers benefit from this because they have to coordinate fewer sub-suppliers". In addition, Hella ensures that the individual components are compatible with each other. The result is highly integrated, multifunctional panels that also feature a distinctive design.

To give the panel an attractive day and night appearance, Hella use various manufacturing processes. For example, structures such as hexagons can be introduced into the surface with a laser. Automakers can choose whether panels are implemented in the vehicle's colour, or in a homogeneous black or chrome look. New technologies such as injection stamping and film back injection produce highly decorative components in accord with customer requirements. At night or when switched on, the light exits are illuminated, while the panels' structures and animations become visible.



But the radiator grille still has life left in it as a design element, even when there's no radiator or combustion engine behind it. Hella's OE lighting package for the electric Škoda Enyaq iV

includes a "Crystal Face" dynamically-illuminated grille. The grille lighting has been available to customers since fall 2021, initially as an optional extra. In the RS and coupé versions of the Enyaq iV, currently being launched, the illuminated radiator grille is standard equipment.

"Together with Škoda, we have developed a comprehensive, highly complex vehicle lighting concept. Above all, the illuminated radiator grille is an absolute eye-catcher and undoubtedly the central trademark of the Enyaq," says Dr. Huber. "This shows once again how important innovative lighting solutions already are today for setting the scene for a car and creating emotions. This makes sophisticated car body lighting a key design element and differentiation aspect. As a leading supplier of automotive lighting technology, we are consistently driving this trend forward".

The grille has 131 LEDs coupling into a thick-walled EdgeLight light guide to illuminate the 18 vertical ribs and a horizontal band of the grille. Together with the surface texture of the ribs, this creates the crystal effect. When opening and closing the vehicle, it also provides welcome and farewell animations.

# New Cars, New Signs of Life at New York Auto Show

## LIGHTING NEWS



The New York auto show is back as an in-person event, and the opening press days included plenty of product news and updates. We notice some themes in the headlamps on new and refreshed models. Dots are hot and lines are fine, as it seems.



The new **Jeep Wagoneer** luxury SUV has a horizontal-lines theme to the eyebrow LEDs across the top of the LED headlamps, while down down in the bumper fascia the fog lamps are dotted horizontal lines.



KIA NIRO



KIA TELLURIDE

The **Kia Telluride**, on the other hand, goes for more of a vertical theme in the headlamps of its first-ever facelift. Each headlamp has two dots at the top and two lines reaching upward from the bottom. The fog lamps in the bumper bar are square clusters of four dots.

The new **Kia Niro** has a modified checkmark or sideways-I shape to DRLs that undersling an over/under headlamp optic configuration.



HYUNDAI PALISADE



HYUNDAI IONIQ 5

There's a strong vertical theme to the **Hyundai Palisade's** front lights, too, with thick DRLs at the outer extents of the front of the SUV, framing its face; the headlamp optics themselves are more traditional framed projectors. And **Hyundai's Ioniq 5**—named World Car of the Year—brings both horizontality and verticality to the game, with its box-shaped DRLs surrounding horizontal oblong headlamp optics.



SUBARU OUTBACK

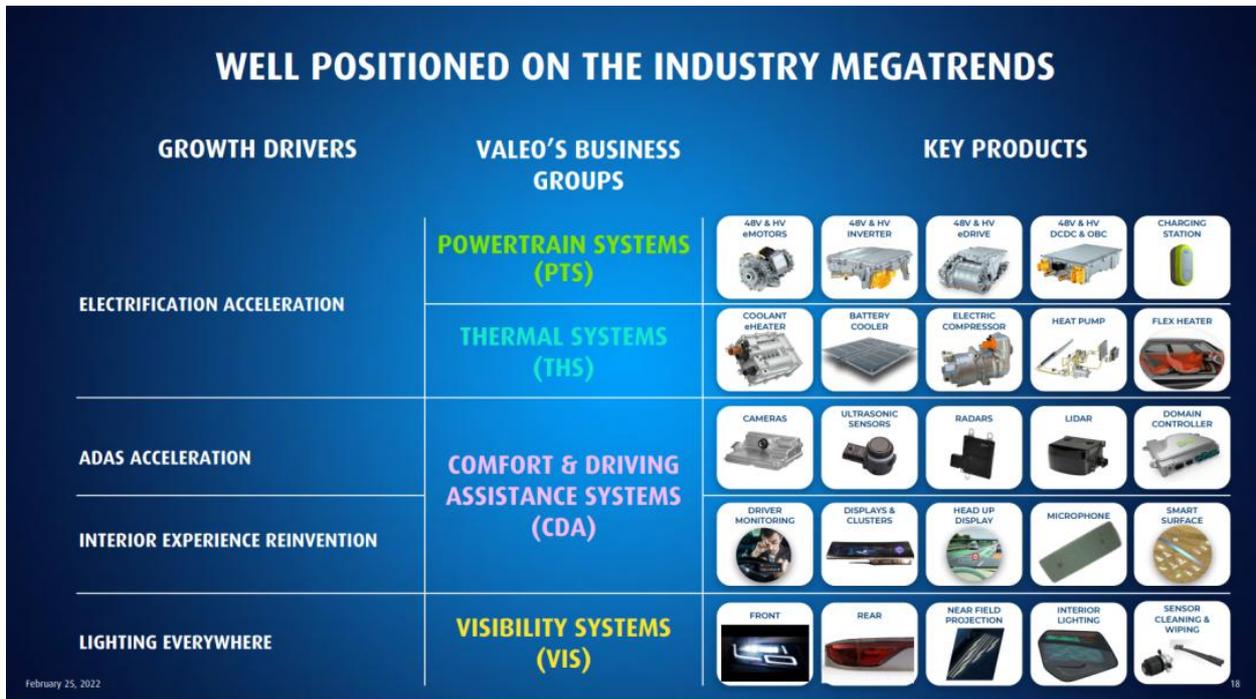


NISSAN PATHFINDER ROCK CREEK

**Subaru's Outback** and **Nissan's Pathfinder** face the world with a balanced blend of traditionally-shaped headlamp housings containing up-to-date LED lighting technology.

# Valeo's "Move Up" Strategy to Boost Sales

## LIGHTING NEWS



Valeo's "Move Up" strategic plan is designed to improve sales over the next four years. It's based on four anchor points: electrification; ADAS; reinvention of interior experience, and lighting.

CEO Christophe Perillat says the plan "will make Valeo stronger, both technologically and financially—we are creating value now, and we are creating a stronger Group that will be capable tomorrow of leveraging the hyper-growth set to take place in its markets".

Valeo's sales of €17.3bn in 2021 are expected to grow to €27.5bn in 2025 (+13 per cent per year) and to €40bn in 2030.

# Design Process "Turning Upside-Down": Ford's New Design Boss

LIGHTING NEWS



Anthony Lo, hired last year, as Ford's chief design officer, plans to put together more concept vehicles as electrification of the automaker's lineup presents what he calls a "once-in-a-lifetime opportunity for us to rethink how a vehicle should look."

Lo told Automotive News "A concept car is not just simply a sculpture, it's a platform for us to test experiences and think, ultimately, how the brand design language should evolve".

Lo's first such concept car will be unveiled tomorrow: a Lincoln EV Ford are calling "inspiration for our fully electric Lincoln vehicles coming in the near future".

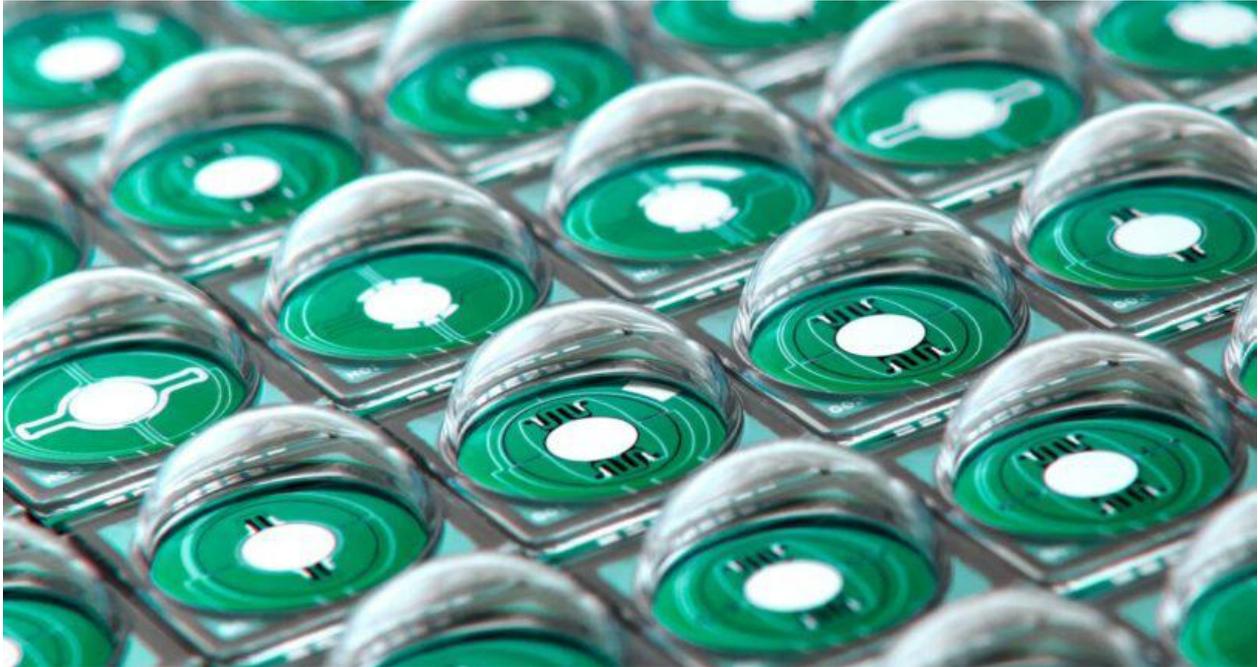
Lo said EVs give designers more flexibility and freedom to craft roomier interiors, which are taking on a greater importance as automakers focus on connected and digital experiences: "In the past, exterior design would always take the lead; it's part of what attracts you to the showroom, but because of the amount of features within the vehicle that you can control as a user, the user interface becomes more and more important. The design process is turning upside-down".

*Anthony Lo, 57, was until April 2021, VP of exterior design for the Renault group – a position during which he was the right arm of Laurens van den Acker. He will thus lead the Ford and Lincoln brands, taking over from Morray Callum.*

# Driver Assistance News

## MEMS Scanner for Smaller, Cheaper Lidar

DRIVER ASSISTANCE NEWS



Under the ægis of the Microelectronics Research Factory of Germany (FMD, Forschungsfabrik Mikroelektronik Deutschland), Fraunhofer scientists and their partners have developed a high-resolution, wide-angle lidar system.

For this project, the Ferdinand Braun Institute supplied a pulsed laser source including control electronics; Fraunhofer IMS (Institute for Microelectronic circuits and Systems) developed a trapping optics with preprocessing electronics, and the Fraunhofer Institute for Silicon Technology (ISIT) produced the MEMS scanners. Integration of the components a complete system was carried out by OQmented, a spinoff from Fraunhofer ISIT.

The laser scanners are manufactured at ISIT with the help of MEMS technology—that is, microchip manufacturing processes are used. For the development of suitable MEMS scanners, ISIT scientists optimised the scanner drivers to allow large deflection angles of the MEMS mirror and a 180° field of view. A dome-shaped glass cover is mounted on the MEMS mirror to protect the device from environmental influences and ensure high optical quality.

The result is a robust, durable, affordable MEMS scanner with a particularly large scanning angle.

# LiangDao, Innoviz Enter Strategic Pact

DRIVER ASSISTANCE NEWS



Innoviz and LiangDao Intelligence have signed a strategic partnership agreement to explore customisation of Innoviz's lidar products for Chinese automakers; development of perception solutions, and validation and data collection to accelerate the introduction of high-resolution lidar for the Chinese market, all based on the InnovizTwo (photo).



As a provider of mass-produced vehicle lidar system, LiangDao's technical team participated in the software series production development for the series production launch of Valeo's Scala, the world's first production lidar system, in Audi's A8. In the next step, the two companies will co-develop a complete lidar hardware assembly line and supply chain system in China to accelerate the advent of widespread high-level autonomous driving.

**LiangDao Intelligence** are a provider of lidar sensors and system components, including automotive-grade lidar hardware, perception software, testing and validation, and data services.

**Innoviz** are a global leader in lidar technology, working towards a future with safe autonomous vehicles on the world's roads.

# Lumentum's Newest VCSELs

DRIVER ASSISTANCE NEWS



Lumentum have announced their new M Series multi-junction VCSEL arrays for next-generation lidar and 3D sensing. M Series VCSELs feature peak powers suited for short- and long-range advanced mobility and industrial lidar applications. They are easily integrated into customer platforms to bring advantages in efficiency, scalability, and reliability that are essential to the accelerating rate of innovation in automotive and industrial lidar and 3D sensing applications.

The first M Series product, the M51-100, is a 905-nm, 70w multi-junction VCSEL array. It is compact, highly reliable, and power-dense. With high power output and a 0.19 mm<sup>2</sup> chip size, the M51-100 is an adaptable solution that can replace edge-emitting lasers in existing mechanical-scan setups, or arrayed into configurable illumination sources for addressable, solid-state electronic scanning lidar systems.

Further M Series product releases are expected later in Q2 of this year.

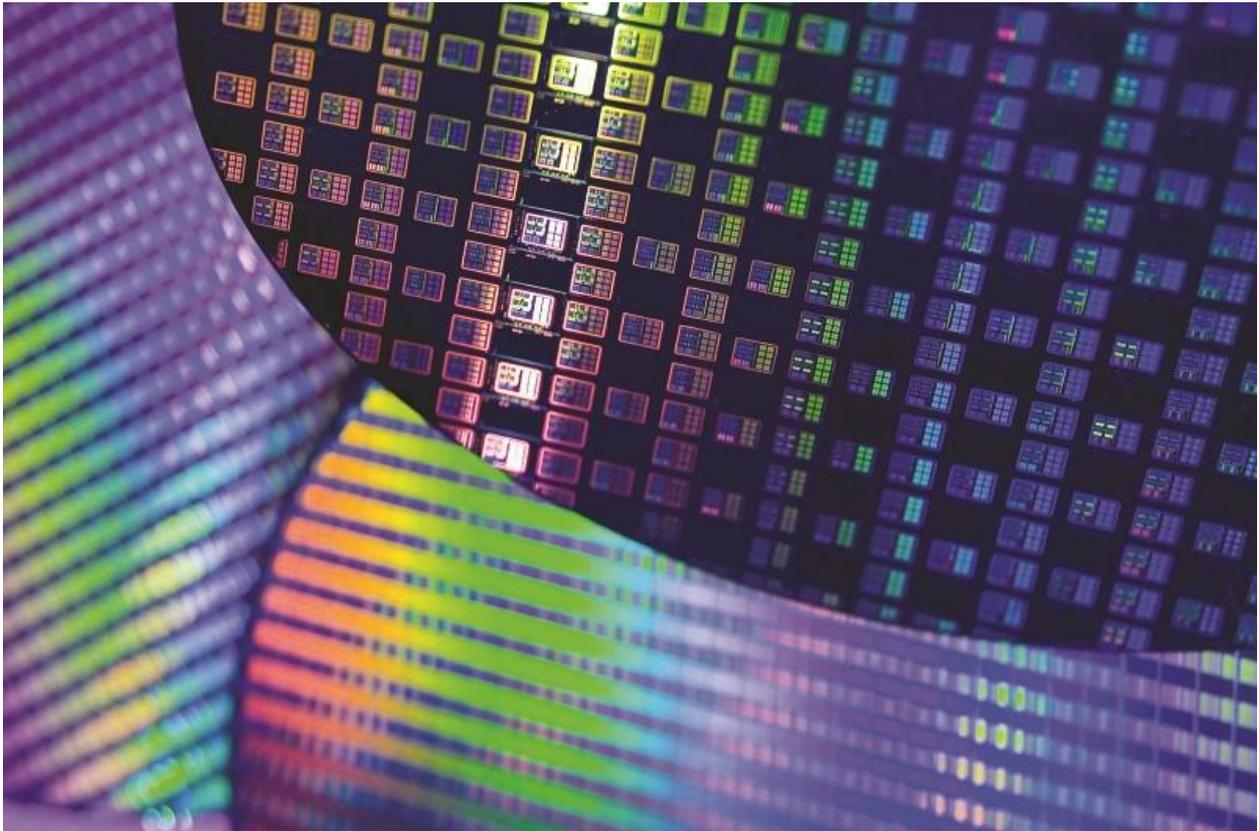
*Lumentum, headquartered in San Jose, California, are a market-leading designer and manufacturer of innovative optical and photonic products enabling optical networking and laser applications worldwide.*

*At the DVN Interior workshop to be held next week in Köln, Germany, Lumentum's 3D sensing product line management director Matt Everett will make a lecture entitled "High-Performance VCSELs for automotive in-cabin applications".*

# General News

## Semiconductor Making Equipment Sales Hit Global High

GENERAL NEWS



Global sales of semiconductor manufacturing equipment—a huge market for lasers and optical components—rose to an all-time worldwide high last year. Figures from the [Semiconductor Equipment and Materials International \(SEMI\)](#) trade group show a total of more than USD \$100bn represented a 44 per cent cent jump from the pandemic-depressed 2020 figure.

The bounceback was led by China, where sales expanded 58 per cent to \$30bn in a fourth consecutive year of growth.

In Korea, sales rose 55 per cent to \$25bn, while Taiwan saw 45 per cent growth and sales of \$25bn. In North America, sales rose 17 per cent to \$7.6bn, and in Europe sales increased by 23 per cent to \$3.25bn.

Taiwan is out in front; \$35bn is expected to be spent on this kind of equipment this year. Meanwhile, spending in China will drop 30 per cent to \$17.5bn, goes the prediction. Taiwan's TSMC, the world's largest chip foundry and responsible for much of the investment there, have reported a 36 per cent year-on-year rise in sales for the opening quarter of this year, another indicator of the present demand levels