

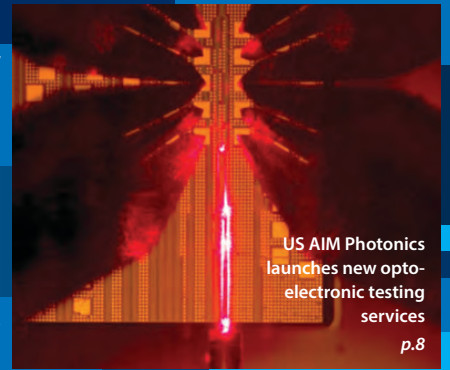
SPIE.OPTIFAB PRODUCT FOCUS

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Vuzix opens 'unique' waveguide facility

Maker of smart glasses says it has begun sampling waveguide components fabricated at its new Rochester facility.

Vuzix, the US-based producer of augmented reality (AR) smart glasses, says that its new optical waveguide manufacturing facility is up and running, with devices now being sampled.

Located adjacent to the Nasdaq-listed firm's headquarters in Rochester, New York, the site currently encompasses 12,000 square feet of primarily class 1K and class 10K clean rooms, with the option to lease a further 27,000 square feet if and when there is sufficient demand.

HUDs and more

Vuzix is planning to both use the waveguides in its own products and for customer programs, with the initial run of components targeted for use in its "Ultralite" OEM platform, for both Android and iOS smart phones.

"In addition to significantly increasing unit capacity and lowering manufacturing costs, the new facility will also focus on the advancement of higher index materials, advanced glass substrates and unique formulation technologies," announced the firm.

"Broad in-house capabilities also include rapid specification to design, mold

production, replication and test, system integration, and waveguide fabrication that will now include small and large format waveguide designs.

"This unique waveguide manufacturing facility enables not only the anticipated multi-billion-dollar augmented reality smart glasses market but other large markets like heads-up displays for in-vehicle use cases and more."

CEO Paul Travers added: "We believe this is a one-of-a-kind production facility, one that significantly leverages our years of waveguide expertise from design through to production.

"Waveguides represent a fundamental cornerstone technology to the AR wearables industry and this facility was specifically designed and built from the ground up to make them in high volumes and at industry-leading competitive costs."

Opportunities

Last month, Travers said that he saw "substantial opportunities" in the OEM side of the Vuzix business, including new programs for defense, consumer, and enterprise products made by its customers.

"As a result, we expect to continue to see strength in our overall revenues for the balance of 2023 fueled by stronger sales of core smart glasses, and engineering services and OEM components that we expect will confirm record revenues for all of calendar 2023," Travers told investors discussing the firm's financial results for the June quarter.

He added that the firm's OEM business, which includes engineering services and waveguide and display engine sales, was gaining momentum with new programs expected to kick-off in the current quarter - with the new facility playing a critical role, and scheduled for an official "grand opening" ceremony in early December.

Last year, the firm agreed a deal with defense contractor L3Harris Technologies to develop a customized waveguide-based optics engine for head-mounted systems designed for military applications.

And in July it announced a similar arrangement with an unspecified OEM customer for waveguides and optical engines set to be designed into a customized head-mounted display solution used across multiple commercial and industrial systems.

The latest results indicated that Vuzix had posted an operating loss of \$9.6 million on sales of \$4.7 million for the three months ending June 30, with just under \$50 million in cash on its balance sheet.

"Our overall outlook for the remainder of 2023 remains unchanged and filled with enthusiasm," Travers concluded at the time.

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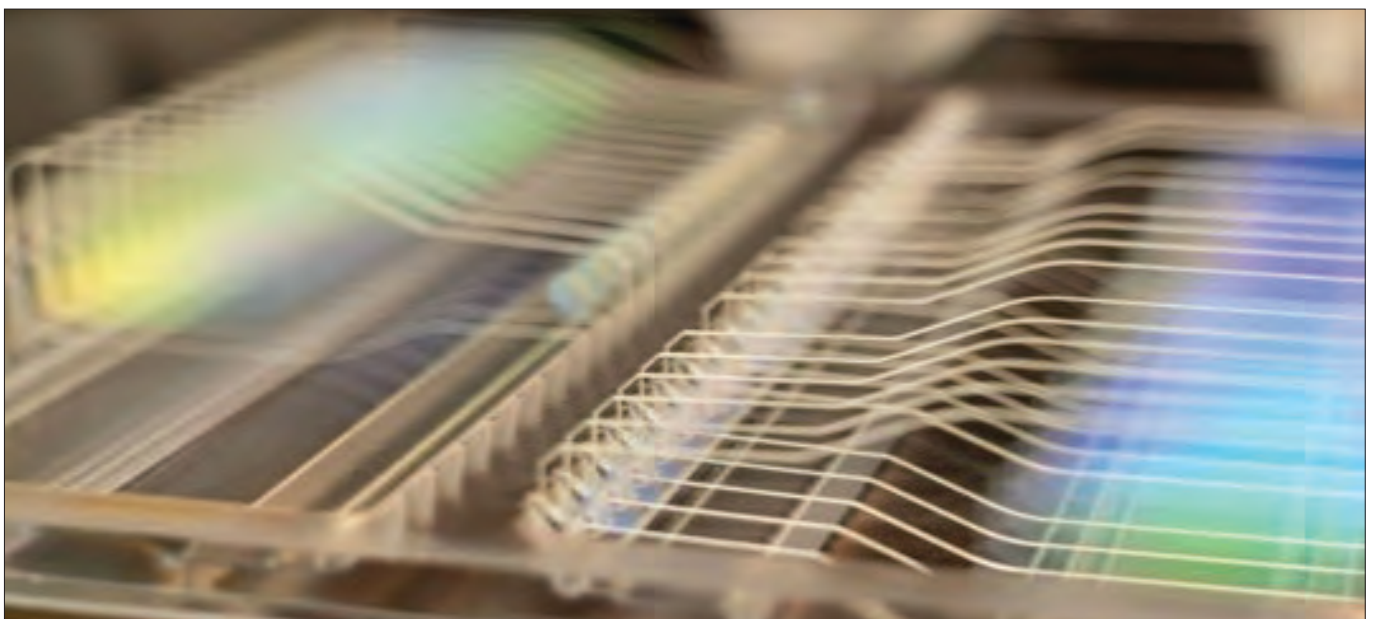
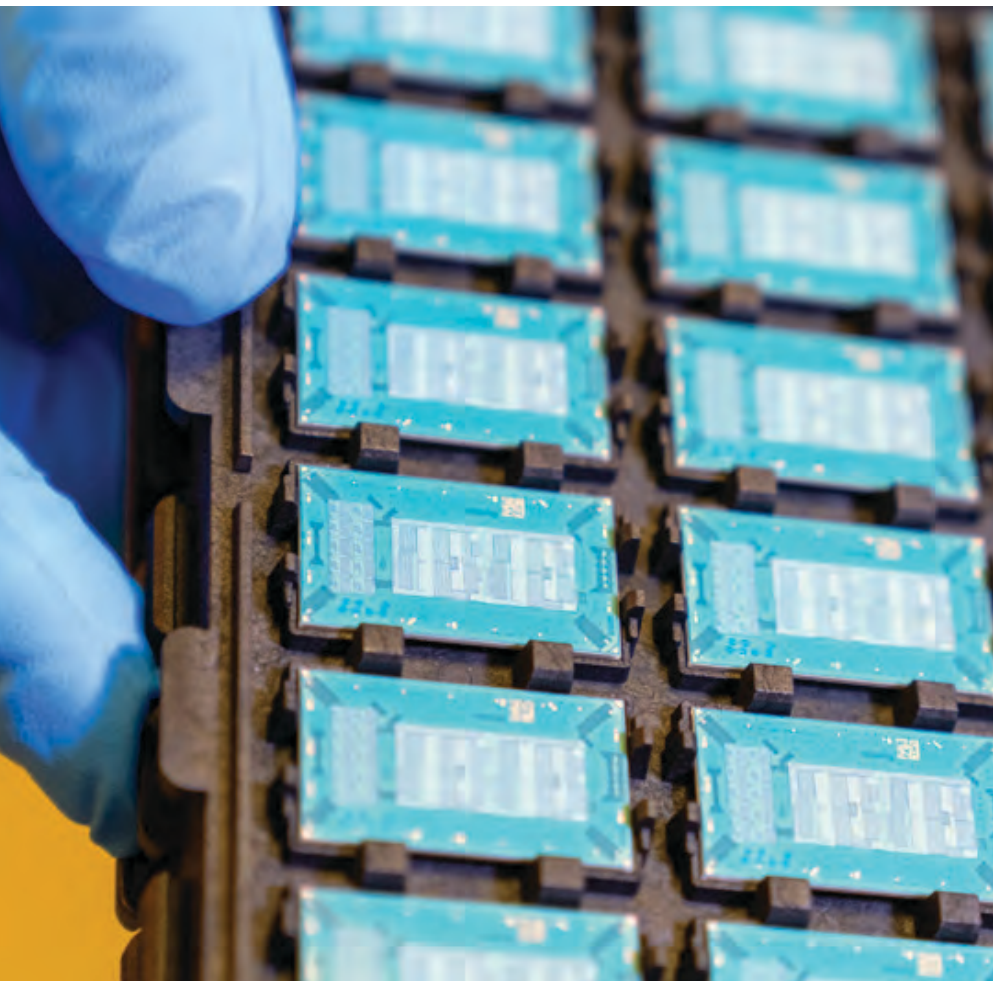


Image: Vuzix Corp.

Vuzix, which is best known for its AR smart glasses, has just begun sampling optical waveguides fabricated at its new state-of-the-art facility in Rochester, New York. The components are set for use both internally and for OEM customer programs.

Intel launches novel glass substrates to enable more powerful compute

New formulations enable order of magnitude boost in designs for future data centers, AI products.



Credit: Intel.

Glass substrate test units at Intel's Assembly and Test Technology Development factories in Chandler, Arizona, in July 2023. Intel's advanced packaging technologies come to life at the company's Assembly and Test Technology Development factories.

Intel has announced a novel glass substrate designed for "next-generation advanced packaging, planned for the latter part of this decade." The company adds that the technology "will enable the continued scaling of transistors in a package and advance Moore's Law to deliver data-centric applications."

"After a decade of research, Intel has achieved industry-leading glass substrates for advanced packaging," said Babak Sabi, Intel senior VP and general manager of Assembly and Test Development. "We look forward to delivering these cutting-

edge technologies that will benefit our key players and foundry customers for decades to come."

Compared to today's organic substrates, glass offers distinctive properties such as ultra-low flatness and better thermal and mechanical stability, resulting in much higher interconnect density in a substrate, the company claims.

These features will allow chip architects to create high-density, high-performance chip packages for data-intensive workloads such as artificial intelligence. Intel says it is "on track to deliver complete

glass substrate solutions to the market in the second half of this decade".

By the end of the decade, the semiconductor industry will likely reach its limits on being able to scale transistors on a silicon package using organic materials, which use more power and include limitations like shrinkage and warping. Scaling is crucial to the progress and evolution of the semiconductor industry, and glass substrates are a viable and essential next step for the next generation of semiconductors.

Supporting growth in computing power

As the demand for more powerful computing increases and the semiconductor industry moves into the heterogeneous era that uses multiple "chiplets" in a package, improvements in signaling speed, power delivery, design rules and stability of package substrates will be essential.

Glass substrates, says Intel, possess superior mechanical, physical and optical properties that allow for more transistors to be connected in a package, providing better scaling and enabling assembly of larger chiplet complexes ("systems-in-package") compared to organic substrates in use today.

Chip architects will have the ability to pack more tiles – also called chiplets – in a smaller footprint on one package, while achieving performance and density gains with greater flexibility and lower overall cost and power usage.

Glass substrates will initially be introduced into the market where they can be leveraged the most: applications and workloads requiring larger form factor packages (i.e., data centers, AI, graphics) and higher speed capabilities.

Glass substrates can tolerate higher temperatures, offer 50% less pattern distortion, and have ultra-low flatness for improved depth of focus for lithography, and have the dimensional stability needed for extremely tight layer-to-layer interconnect overlay.

As a result of these distinctive properties, a 10x increase in interconnect density is possible on glass substrates. Further,

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Intel launches novel glass substrates to enable more powerful compute

improved mechanical properties of glass enable ultra-large form-factor packages with very high assembly yields.

Glass substrates' tolerance to higher temperatures also offers chip architects flexibility on how to set the design rules for power delivery and signal routing because it gives them the ability to seamlessly integrate optical interconnects, as well as embed inductors and capacitors into the glass at higher temperature processing.

This allows for better power delivery solutions while achieving high-speed signaling that is needed at much lower power. These many benefits bring the industry closer to being able to scale 1 trillion transistors on a package by 2030.

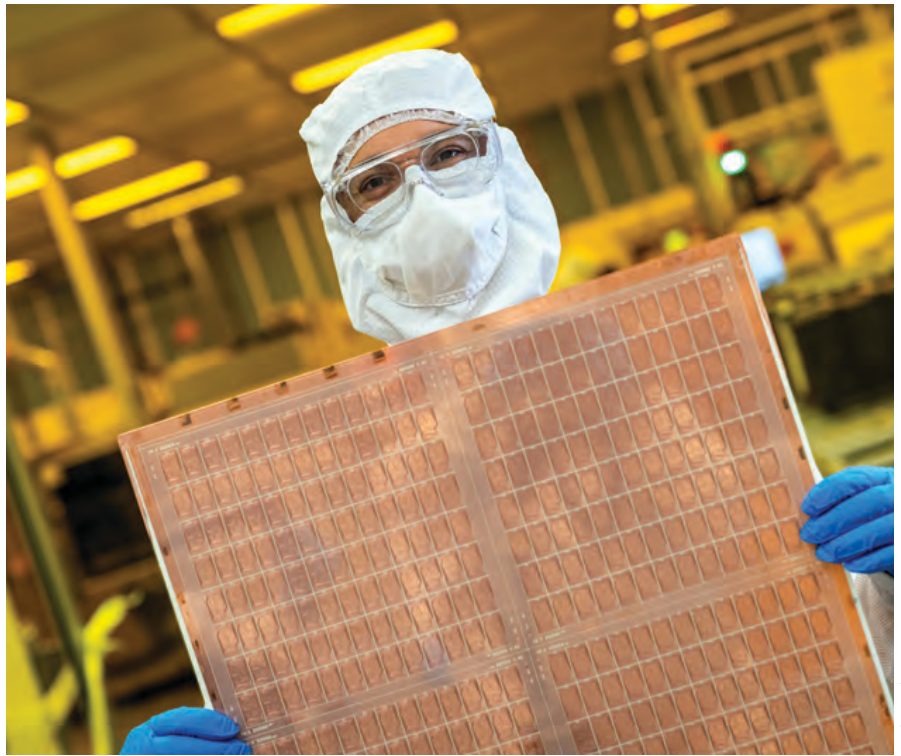
Track record of R&D

Intel has been researching and evaluating the reliability of glass substrates as a replacement for organic substrates for more than a decade. The company has a long history of enabling next-generation packaging, having led the industry in the transition from ceramic package to organic package in the 1990s, being the first to enable halogen and lead-free packages, and being the inventor of advanced embedded die packaging technologies, the industry's first active 3D stacking technologies.

Building on the momentum of recent PowerVia and RibbonFET breakthroughs, these industry-leading glass substrates for advanced packaging demonstrate Intel's forward focus and vision for the next era of compute beyond the Intel 18A process node.

Intel says it is on the path to delivering 1 trillion transistors on a package by 2030 and its ongoing innovation in advanced packaging including glass substrates will help achieve this goal.

<https://optics.org/news/14/9/28>



Credit: Intel.

An Intel engineer holds a test glass core substrate panel at Intel's Assembly and Test Technology Development factories in Chandler, Arizona, in July 2023. Intel's advanced packaging technologies come to life at the company's Assembly and Test Technology Development factories.



Credit: Intel.

Hamid Azimi, corporate vice president and director of substrate technology development at Intel Corporation, holds an Intel assembled glass substrate test chip at Intel's Assembly and Test Technology Development factories in Chandler, Arizona, in July 2023. Intel's advanced packaging technologies come to life at the company's Assembly and Test Technology Development factories.

EMO 2023: 3D printing innovations enable new applications, save material

Users of the Trumpf development can print components with overhangs to 15 degrees without support.

Engineering and laser company Trumpf has announced improvements to its 3D printing software TruTops Print. Users can now print parts with extreme overhang angles as low as 15 degrees without requiring support structures. The new technology was showcased at EMO 2023, a production technology trade fair, which took place in Hannover, Germany, between September 18 to 23.

“The latest version of TruTops Print software eliminates the need for virtually all support materials, which ultimately means quicker builds and lower material consumption,” commented Lukas Gebhard, process development engineer for additive manufacturing at toolcraft. “Support-free printing gets parts close to their final shape. It opens the door to parts and projects that were previously impossible, such as the near-net-shape manufacturing of large-diameter internal cooling channels.”

In the past, users had to print support structures together with the part in order to anchor the part to the build platform. These structures also serve to dissipate heat



TruTops Print allows users to print parts with extreme overhangs as low as 15 degrees without requiring support structures.

from the printed part and prevent internal tensions and deformations during printing.

Trumpf says its new technology means that many 3D printing applications can now be carried out without supports, even when tackling hard-to-process materials such as stainless steel.

New 3D strategies

Timo Degen, product manager for additive manufacturing at Trumpf, said, “When we

same time, the improved gas flow of TRUMPF’s new 3D printers caters to uniform processing conditions and support-free printing.

“Users from any industry can benefit from the ability to 3D print parts without supports. The advantages of support-free printing are particularly appealing for parts that feature large cavities or challenging overhangs,” said Degen. Examples include tanks, heat exchangers, hydraulic blocks and tool molds.

The new technology also opens up new applications that couldn’t be properly exploited when support structures were still necessary, including areas such as additively manufactured radial compressors and shrouded impellers. Previously, manufacturers were unable to print support-free impellers due to their overhang angles. “The need for supports meant that 3D printing wasn’t an economically viable alternative to conventional manufacturing. But now things are different,” said Degen.

www.trumpf.com

www.emo-hannover.de/en

<https://optics.org/news/14/9/16>



Caps 01 Support-free 3D printing. The advantages of support-free printing are particularly appealing for parts that feature large cavities or challenging overhangs. Photo: Trumpf. 02 TruTops Print allows users to print parts with extreme overhangs as low as 15 degrees without requiring support structures. Photo: Trumpf. 03 TruTops Print enables the 3D printer to use the optimum printing strategy for each different area of the part, thus eliminating the need for support structures.

Optical coating approach prevents fogging and unwanted reflections

Technology helps sensor and camera systems perform optimally by keeping optics transparent.

Researchers in Germany have developed an optical coating system that combines antifogging and antireflective properties. The new technology could help boost the performance of lidar systems and cameras.

“Walking into a warm room from the cold outside can cause glasses to fog up, blinding the user,” said research team leader Anne Gärtner from Fraunhofer Institute for Applied Optics and Precision Engineering (IOF) and Friedrich Schiller University Jena, both in Jena, Germany.

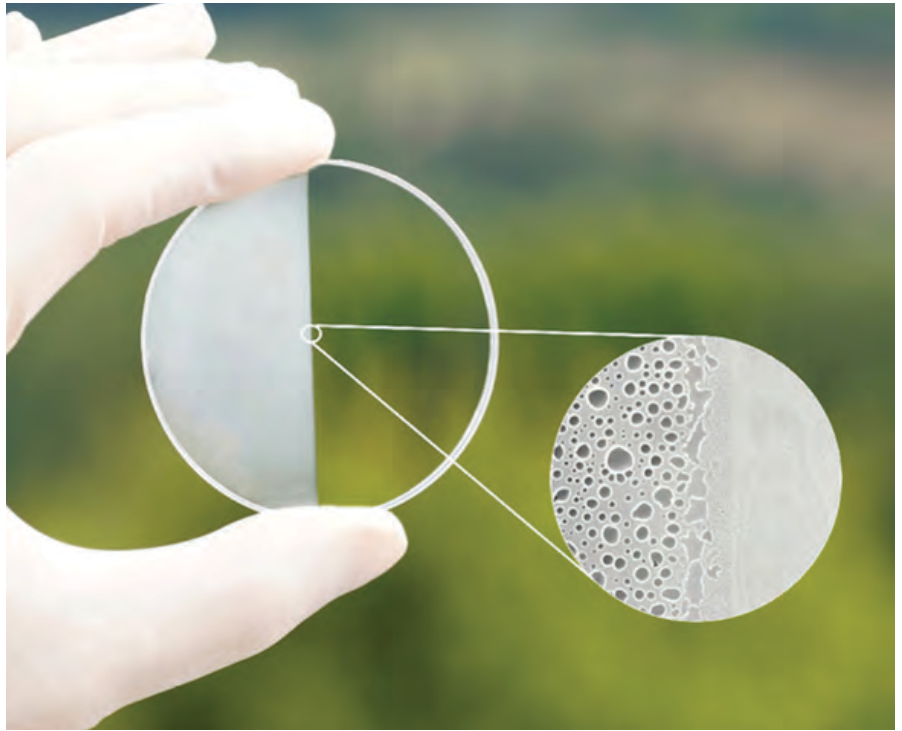
She added, “The same can happen to sensors such as the lidar systems used in autonomous cars. It is important that surfaces remain highly transparent, even if fogging occurs, so that functionality is maintained.”

Gärtner and colleagues describe in Applied Optics, how they combined a polymer coating that prevents fogging with porous silicon dioxide nanostructures that reduce reflections. Although the coatings described in the paper were designed specifically for lidar systems, the technology can be tailored for many different applications.

“In our coating system the anti-fogging and anti-reflective properties are excellently combined, something which has not been previously feasible,” said Gärtner. “Samples manufactured with this new coating technology have already been used successfully for a year in several airborne lidar prototypes operating in various climatic conditions around the world.”

Seeing more clearly

The coating system described in the paper was developed in response to a need identified by Leica Geosystems, Heerbrugg, Switzerland. Leica Geosystems develops airborne lidar measurement systems that are used for terrain and city mapping. When there are extreme temperature



Optical coating system combines antifogging and antireflective properties. The new technology could help boost the performance of lidar systems.

differences between the environment and the measuring system, fogging sometimes occurs on the optical surfaces, impairing functionality. Gärtner’s team collaborated with Leica Geosystems to develop a solution that managed the fogging as well as undesirable light reflections.

“We used a polymer that prevents fogging on an optical surface by acting as a water reservoir,” said Gärtner. “However, differences in the refractive indices of the polymer material and the surrounding air leads to unwanted reflections and ghost light. To prevent these reflections, we combined the antifog film with very small structures — up to 320 nm high — to create an anti-reflective effect together with water permeability.”

To make the multifunctional coating system, the researchers applied “AR-plas2” technology, developed at the Fraunhofer IOF. It allows several nanostructures to be created on top of each other. The process

involved etching a nanostructure into the antifog coating and then fabricating a second nanostructure on top.

With this technology, it is possible to adjust the refractive indices of the nanostructures to tailor the design of the double nanostructure to achieve very low reflection over a wide spectral range.

Laboratory tests showed that the resulting multi-layer system exhibited

very low reflection over a wide spectral range, which would be impossible with a single nanostructure. Additionally, the nanostructures did not affect the coating’s antifog properties.

Real-world applications

Because the structures are generated in a standard plasma-ion-assisted coating machine, the new approach can be easily incorporated into commercial manufacturing processes. In addition to being applied in several lidar prototype systems, the coating technology is already being used in cutting-edge smart phone cameras.

The researchers are now exploring how the coating system could be transferred to other areas such as adaptive lighting systems in the automotive sector or the development of quantum computers.

<https://optics.org/news/14/1/28>

Credit: Anne Gärtner, Fraunhofer Institute for Applied Optics and Precision Engineering and Friedrich Schiller University Jena.

US AIM Photonics launches new opto-electronic testing services

Expands access to client firms to advanced testing capabilities for prototypes.

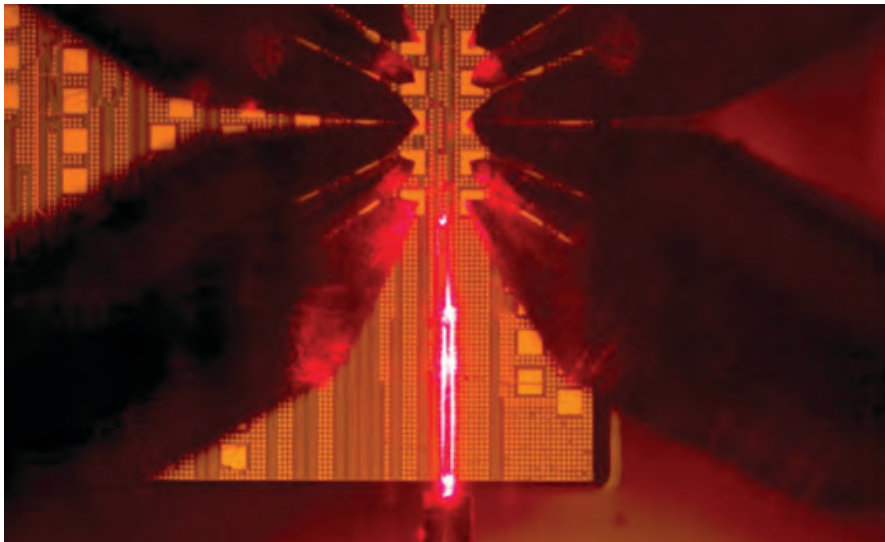


Image: AIM Photonics.

Die-level edge-coupling based electro-optic measurements.

AIM Photonics, the industry-driven research institute based in Albany, New York, has announced the launch of its new Opto-electronic Testing Services, which feature a full suite of advanced tools for testing both photonic integrated circuits (PICs) as well as conventional electronic ICs.

The new service will be offered through AIM's Test, Assembly and Packaging facility in Rochester, NY, which AIM says is the only place in the U.S. that provides access to both photonic and electronic test, assembly, and packaging prototyping services for substrates up to 300 mm wafers.

"Our comprehensive toolset can test and measure multiple performance aspects of electronic and photonic devices before and immediately after package assembly, allowing for rapid verification and optimization of the manufacturing process all in the same R&D center, saving our members and customers valuable time and resources," said Chris Striemer, Business Development and Facilities Manager at AIM Photonics test, assembly and packaging facility.

AIM's Opto-electronic Testing Services currently include over 30 tools for

passive optical, active optoelectronic, telecom/datacom, and RF and DC testing. "Providing access to these services is core to our mission to expand the silicon photonics ecosystem," Striemer added.

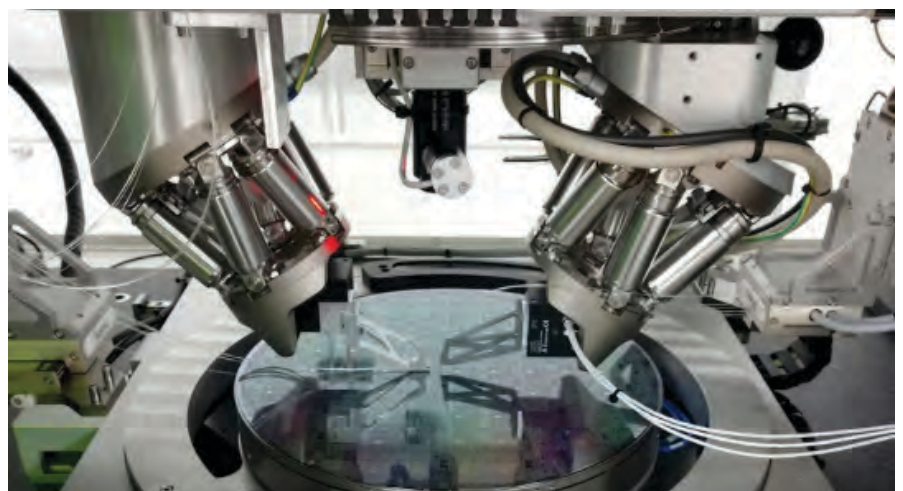


Image: AIM Photonics.

The large automated probe in AIM Photonics' test lab enables programmable optical, DC and RF interrogation of wafer substrates as large as 300 mm, with additional flexibility for die-level testing.

Multiple tools

"With this toolset, we are able offer a wide range of testing capabilities for on-wafer, die-level, and packaged devices, all aimed at achieving consistent and reliable results to support our members' and customers' prototype development."

Striemer also said that the funds recently

authorized through Empire State Development by the NYS Photonics Board will further expand AIM Photonics' test and measurement capabilities over the next several years through additional hardware and partnerships with Rochester area colleges and universities.

"Our customers include not only small businesses, academics, and of course our government partners, but also research and development groups in companies—both large and small—that want to explore photonics without having to invest in testing infrastructure," said Amit Dikshit, design enablement manager at AIM Photonics.

Purchasing advanced test and measurement tools can be cost-prohibitive for many companies, particularly start-ups with limited resources, Dikshit added. "Even basic test capability could cost several hundred thousand dollars and take up to a year to purchase, install and test," he said.

"Having access to our extensive testing

capabilities—as well as our finely-tuned methodologies—allows our members and customers to leave the testing to us, freeing them to focus their efforts on designing and developing their own innovative devices and technologies," Dikshit said.

<https://optics.org/news/14/5/34>

Rochester Professor Julie Bentley elected into SPIE presidential chain

Society's next vice president is also the president of Bentley Optical Design.

Julie Bentley, of the University of Rochester, NY, has been elected to serve as the 2024 vice president of SPIE, the international society for optics and photonics. With her election, Bentley joins the SPIE presidential chain. She will serve as president-elect in 2025, and as the Society's president in 2026.

The 2023 SPIE President Bernard Kress, director of XR hardware at Google, made the announcement along with other SPIE election results at this year's Annual General Meeting of the Society on 22 August, during SPIE Optics + Photonics, in San Diego. Terms begin on 1 January 2024.

Profile

Bentley, a professor at the University of Rochester's Institute of Optics, who began her academic career in optics as a student at the university, is a recognized expert in designing lenses and optical systems, as well as a much-lauded instructor.

She is the 2022 recipient of the university's Edmund A. Hajim Outstanding Faculty Award, as well as a 2014 recipient of the university's Goergen Excellence in Undergraduate Teaching Award. In 2019, she received the RRPC Education Award from the Rochester Regional Photonics Cluster. She is also a private consultant and holds four patents in optical design and engineering.

An SPIE Fellow Member since 2012, Bentley has had extensive involvement with the Society. She also served on the SPIE Board of Directors 2014-17, and has served on the Scholarship, IT, Education, Awards, and Publications Committees.

Bentley has also chaired the Joseph W. Goodman Book Writing Award, and has co-authored two books for SPIE Press, *Field Guide to Lens Design* and *Designing Optics Using CODE V*. In 2022, Bentley received the SPIE Directors' Award, one of the Society's highest honors.

"I am very excited to have been chosen to serve as the next vice president of SPIE," said Bentley. "The last few years have been challenging to navigate for us all: the



Top row, from left to right: Julie Bentley, Jim McNally, Samuel Achilefu. Bottom row, from left to right: Agnes Huebscher, Daewook Kim, Michelle Stock.

Photo composite: SPIE

pandemic changed how we work, learn, and interact. As a professor with a new semester just weeks away, I find myself searching for the best way to balance previous methods of teaching with the rapidly developed technological advancements that have improved our ability to deliver course content to students."

She added, "In a similar fashion, I am looking forward to working with the incredible team at SPIE to find the best ways to embrace recent changes, using them to grow the Society while maintaining the community-focused aspects we all love about SPIE."

<https://optics.org/news/14/8/37>

Further appointments

Alongside Bentley, Jennifer Barton, director of the BIO5 Institute at the University of Arizona, will serve as the 2024 SPIE President while Zygo's Peter De Groot will serve as President-Elect. Jim McNally, CEO of StratTHNK Associates, was elected to serve as the 2024 SPIE Secretary/Treasurer.

The following newly elected Society Directors will serve three-year terms from 2024-2026:

- Samuel Achilefu, professor and chair of the University of Texas Southwestern Medical Center's department of biomedical engineering.
- Agnes Huebscher, Edmund Optics' senior director of global strategic marketing.
- Daewook Kim, associate professor at the University of Arizona's Wyant College of Optical Sciences.
- Michelle Stock, TraInnovations' director of business development and sales, North America.

Edmund Optics invests in new Florida manufacturing plant...

...and Hamamatsu opens another electron tube and X-ray source factory building in Toyooka, Japan.

Edmund Optics, a manufacturer of laser optics coatings, components, and assemblies optimized for high-power laser systems, has expanded its footprint in Oldsmar, FL, USA.

Its new, state-of-the-art 34,000 sq. ft. Laser Optics Center is dedicated to manufacturing a variety of optical components with high laser damage thresholds from the ultraviolet to the far infrared.

"We are excited to significantly enhance our laser optics manufacturing capabilities and capacity with the new Florida facility," said Marisa Edmund, Chairman and Chief Marketing & Sales Officer for Edmund Optics.

"With more than thirty years of regional presence and global design, manufacturing, and applications expertise, we are well-equipped to respond to customer demand for increasingly high-quality laser optics," said Edmund.

The new facility expands Edmund Optics' laser optics manufacturing



Edmund Optics' 34,000 sq. ft. Laser Optics Center has opened in Oldsmar, Florida.

capabilities across laser crystal and glass fabrication, polishing, metrology, inspection, and testing, and is already home to approximately 50 employees, specializing in complex, high laser damage threshold coatings and designing for manufacturability.

Dr. Stefaan Vandendriessche, Director, Laser Optics Business Line for Edmund Optics, said, "This new facility enables us to better support innovative applications through our expanded development, manufacturing, and assembly capabilities."

Hamamatsu completes new factory building in Toyooka

Hamamatsu Photonics has been constructing a new factory "Building No. 11" at its Toyooka factory site, in Iwata City, Japan. The development is to manage expanding sales of its microfocus X-ray sources and other electron tube products. The facility has now been completed and will start operations this month. The completion ceremony was held on Friday, August 4th.

Hamamatsu stated, "In this new factory building, we will enhance our production capacity and thereby expand the sales of the electron tube business up to ¥100 billion (\$700 million) by the fiscal year ending September, 2027."

Considering wider market conditions, Hamamatsu's statement added, "Demand for microfocus X-ray sources used with imaging devices in non-destructive inspection of printed circuit boards for data servers and electric vehicle batteries is rapidly expanding.

"We can also count on the increasing sales of low-energy electron beam generators for printing and sterilization applications, and medical scintillators for converting X-ray into visible images."

<https://optics.org/news/14/8/10>



Hamamatsu's "Building No. 11" at its Toyooka site.

Namuga selects Lumotive to manufacture 3D sensing solutions

Korea-based camera module maker Namuga is a supplier for Samsung's smart phones.

Optical semiconductor developer Lumotive has entered a commercial agreement with camera module specialist Namuga, which will use Lumotive's Light Control Metasurface (LCM) chipsets to develop solid-state lidar module solutions for a range of 3D sensing applications.

Publicly-traded in South Korea, Namuga makes cameras and 3D sensing modules. These components are integral to a variety of consumer electronics products such as notebooks, smartphones, and smart home automation. As a supplier for Samsung Electronics' flagship smart phones, including the Galaxy S23, Namuga also provides diverse capabilities for drones, head-mounted and head-up displays.

Using metamaterial-based technologies to steer laser beams without moving parts, Lumotive's LCM overcomes the size, scalability and reliability limitations of conventional mechanical beam steering systems.

Namuga says its expertise in the miniaturization of sensing modules, combined with the intrinsic advantages of LCM-based beam steering, "will enable lidar to expand into new domains of 3D

sensing, particularly applications where compactness and weight are crucial."

Expanding the market

The partners aim to create a variety of solid state lidar modules that go beyond robotic automation solutions, extending into additional sectors such as services, homecare, and logistics. Lumotive's technology broadens Namuga's capabilities in perceiving surrounding information, enhancing performance and opening avenues into future ventures such as autonomous driving vehicles.

Dr. Sam Heidari, CEO of Lumotive, commented, "Our mission is to catalyze mass accessibility of solid-state lidar by partnering with innovative sensor makers like Namuga. We eagerly anticipate the application of our LCM digital beam steering chipsets in a broad spectrum of use-cases."

Tae Youn Won, CEO of Namuga, said, "Through this partnership we will accelerate the development of next-generation lidar technology and secure a technological and manufacturing competitive advantage in the global market. Based on Namuga's leading 3D sensing camera technology,

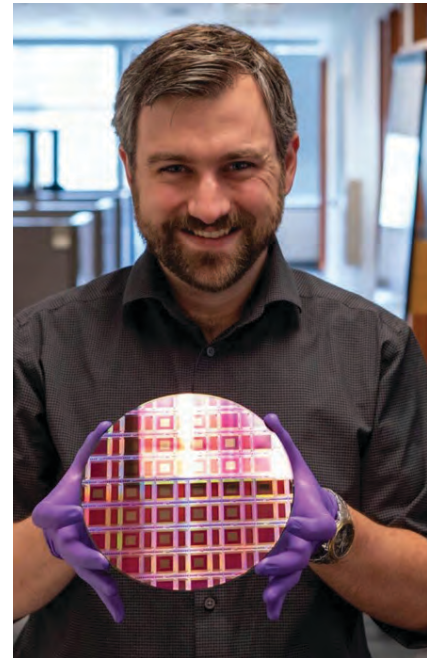


Image: Lumotive.

Light Control Metasurface™ (LCM) beam steering chips - now available as part of Lumotive's Technology Access Program.

we will take the lead in not only the autonomous driving car market, but also the next-generation device technology markets such as robotics, XR, and other innovative technologies."

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ams Osram announces refinancing plan for large debts used to fund 2020 acquisition

Strategic reorganisation involves €2.25 billion in rights issue plus bonds; firm calls EGM for October 20th.

Photonics and sensing systems giant ams Osram has announced that it plans to strengthen its balance sheet for structural growth targeting investment grade profile. The company plans to secure a total of €2.25 billion (\$2.37 billion) through the combination of a capital increase, new corporate bonds, and other financing instruments.

The announcement rapidly follows last

monetizing innovation," he said.

Multi-stage plan

The comprehensive financing follows a multi-stage plan: A proposed rights issue in the amount of €800 million will be combined with an issuance of senior unsecured notes in EUR and USD, which are expected to raise a total of around €800 million.



- Combination of a rights issue, senior unsecured notes and other financial instruments, in total EUR 2.25bn, covering all expected financing needs until 2025/26.
- Financing of around EUR 1.9bn (out of total EUR 2.25bn) in fall/winter 2023/24:
 - a rights issue of EUR 800m, for approval at Extraordinary General Meeting (EGM) on 20-Oct-2023,
 - a new issuance of senior unsecured notes of around EUR 800m, and
 - asset-level financings of around EUR 300m.
- Additional debt instruments of around EUR 350m will complete the package in 2024 in a mix subject to market conditions.
- Comprehensive financing plan to increase equity ratio to approx. 30% and to reduce debt, with the aim of achieving investment grade profile by 2026.
- Q3 profitability expected to reach the upper end of the guided range of 5% - 8% adjusted EBIT, Q3 guidance for revenues of EUR 840m to 940m reconfirmed.

Restructuring and refinancing highlights.

month's news that German and Bavarian public financing totaling €300 million is to be invested in ams Osram's facility in Regensburg.

Aldo Kamper, CEO, stated, "Step by step we deliver what we have outlined. Firstly, we have sharpened our strategy towards structural growth. Secondly, we are cleaning-up our semiconductor portfolio by exiting non-performing businesses. Thirdly, we are making our organization efficient and accountable.

"The foundation for 're-establishing the base' of ams Osram is having a solid and sustainable capital structure. With the holistic financing plan we present today, we aim to put our balance sheet on a solid footing, such that we can fully concentrate on executing our strategy for growth, higher profitability and

The volume of the capital increase, which is scheduled for approval at an Extraordinary Shareholders meeting on October 20th, 2023, is underwritten by the banks HSBC, Morgan Stanley and UBS.

The total financing package is expected to be completed next year with an additional €350 million in a mix of debt instruments, such as unsecured notes, bi-lateral debt facilities, or other instruments – the mix will be subject to market conditions.

Rainer Irlle, CFO, commented, "The multi-element financing plan is designed to strengthen the balance sheet of ams Osram. Our comprehensive plan consists of new equity to reduce gross and net debt as well as new senior notes to refinance additional outstanding debt

with a well-balanced maturity profile. We will also use additional financing instruments, such as sale & lease back transactions, with the aim of bringing the company on track to reach a healthy investment grade leverage."

'Focusing on intelligent sensors and emitters'

ams Osram stated that the financing plan creates a solid base for the strategic realignment of the company, which is focusing its semiconductor portfolio on its profitable core business with intelligent sensor and emitter components.

The company aims to expand its leading position in the relevant automotive, industrial, and medical sectors. This will be complemented by selected, highly innovative offerings for the consumer electronics markets, such as micro-LED. The statement added that "the Automotive & Specialty Lamps segment continues to be an important part of the Group after its portfolio was cleaned up and is delivering sustainable double-digit pre-tax margins".

The new strategy and the associated efficiency program 'Re-establish the Base' aim to align the Group with the focused semi-conductor portfolio and to strengthen profitability with expected run-rate savings of around EUR 150 million by end of 2025. The company stated that it is "well on the track for achieving this".

The organizational adjustments to strengthen accountability and to make the set-up leaner (e.g. reducing from 4 to 3 business units) are close to being fully implemented. Preparations are progressing for the exit of the passive optical components business, which is no longer part of the core business. Initial talks with interested parties are promising. Potential proceeds from a sale of the non-core semiconductor portfolio could also be used to reduce leverage.

Further details of the financing plan fall/winter 2023/24 and an associated Extraordinary General Meeting for Rights Issue are available on the company website www.ams-osram.com

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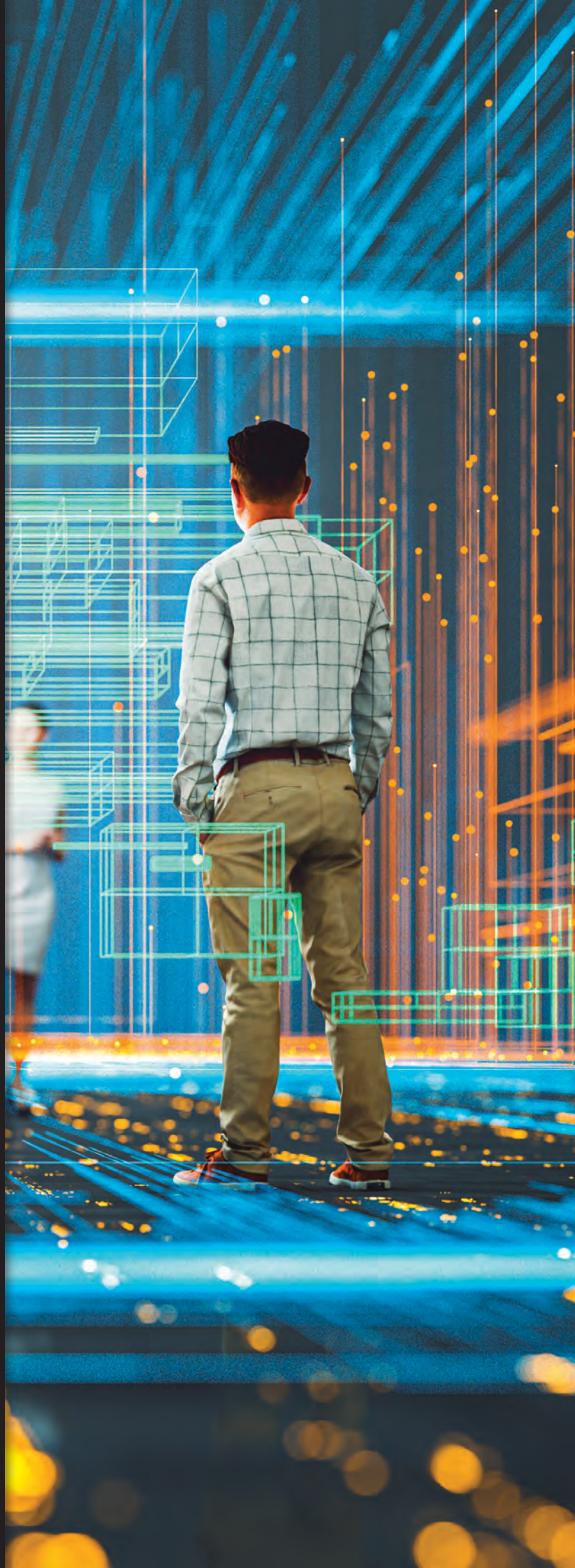
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BAE Systems to acquire Ball Aerospace for \$5.6BN

Business known for its space telescope expertise set to become part of the global defense giant.

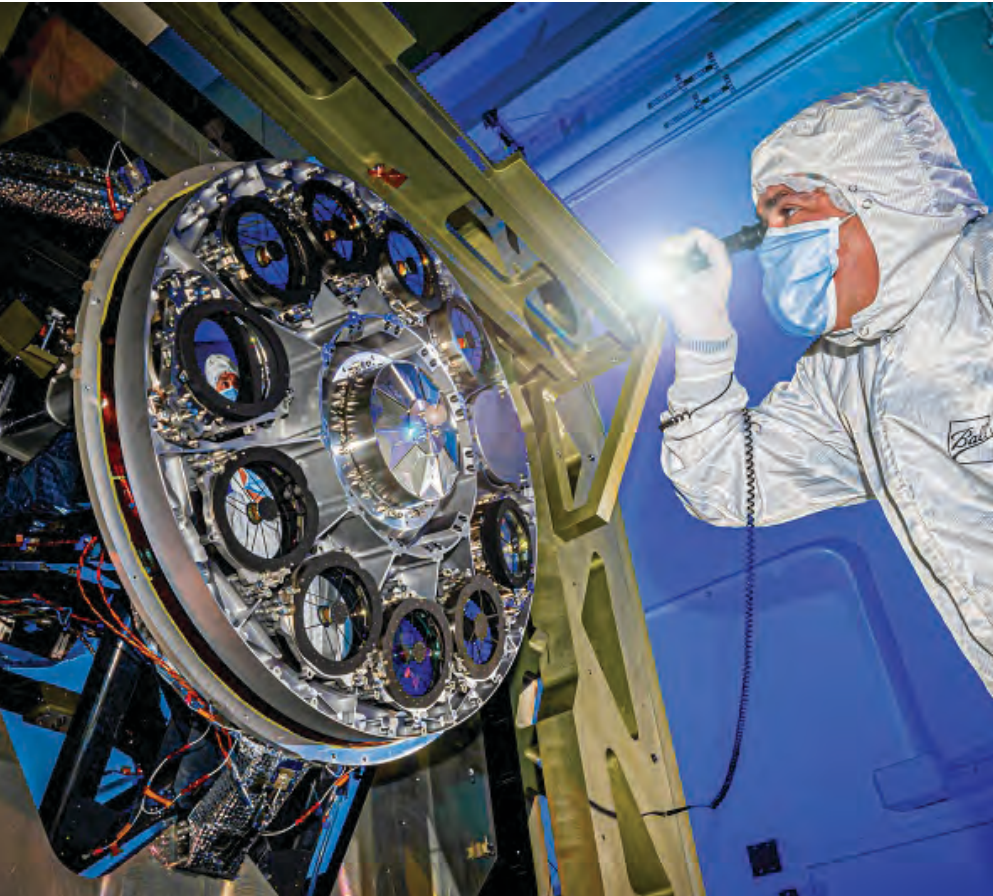


Photo: Business Wire.

The Nancy Grace Roman Telescope, currently being built by Ball Aerospace, will feature a much wider field of view than predecessors like Hubble and JWST.

Ball Aerospace, the company that built the James Webb Space Telescope (JWST), is set to become part of BAE Systems, in a cash deal valued at \$5.6 billion.

Announcing the agreement, which remains subject to regulatory approvals, BAE Systems said that the acquisition would advance its position in some of the fastest-growing segments of the defense market, which includes precision optics and state-of-the-art imaging technologies.

"Ball Aerospace has a long and distinguished track record as a proven partner and pioneering innovator, with expertise in spacecraft, mission payloads, optical systems, conformal antennas, and electronically steered arrays," BAE Systems noted.

Its CEO Charles Woodburn added: "It's rare that a business of this quality, scale and complementary capabilities, with strong growth prospects and a close fit to our strategy, becomes available."

In a separate announcement Ball Corporation - the aerospace division's parent company - said that the deal should be completed in the first half of next year.

Ball CEO Daniel Fisher said: "BAE Systems is well-positioned to invest in Ball Aerospace to elevate the combined business to new heights, generate significant value to critical mission partners, offer customers more affordable solutions, and enable a safer world for all stakeholders benefiting from today's agreement."

From a corporate point of view, the transaction will enable Ball - which had said in June that it was "considering options" for the future of the aerospace division - to concentrate on its core business of making aluminum cans.

Space telescopes and electro-optics Following on from its success with the Hubble Space Telescope and JWST, Ball Aerospace has been selected to design and develop the Wide Field Instrument (WFI) Opto-Mechanical Assembly for NASA's Nancy Roman Space Telescope mission.

The assembly includes the optical bench, thermal control system, precision mechanisms, optics, electronics, and the relative calibration system, and also provides the stable structure and thermal environment that will enable the wide field, high quality observations of WFI.

In contrast to missions such as JWST and Hubble, Ball's design will ensure that the Roman telescope has a much wider field of view, capturing images approximately the size of the full moon as viewed from Earth.

Other projects where Ball Aerospace is playing a lead role include the MethaneSAT mission to spot emissions from oil and gas operations from space, currently slated for launch in early 2024.

The "LandSat-9" satellite, launched in 2021, also features a state-of-the-art imaging system built by Ball Aerospace, capable of capturing scenes across a 185 km swath with each pixel representing an area about 30 m across - and therefore able to identify areas such as individual crop fields.

Other photonics-related areas of expertise include cameras, high-bandwidth laser communication links and lidar imaging technologies, while the division also produces components for electronic warfare, and surveillance.

Headquartered in Colorado, Ball Aerospace currently employs around 5200 people, 60 per cent of whom hold US security clearances.

www.baesystems.com

<https://optics.org/news/14/8/27>

MESA+ Institute develops tool to measure plasma source and wavelength...

...and fellow Twente, Netherlands, company Superlight Photonics announces completion of seed investment round.

Researchers at MESA+ Institute for Nanotechnology, part of the University of Twente, in the Netherlands, have developed a tool that can measure the size of a plasma source and the wavelength of the light it emits simultaneously.

Measuring both parameters at the same time enables MESA+ researchers to further improve lithography machines with the aim of developing smaller, faster and improved chips.

The work is highlighted as an "Editor's pick" in Optics Letters.

Lithography machines are central to the process of making the microchips that are needed for almost all electronic devices. To produce the smallest chips, these machines require precision-engineered lenses, mirrors and light sources.

"Traditionally, we could only look at the amount of light produced, but to further improve the chipmaking process, we also want to study the wavelengths of that light and the size of its source," commented Muharrem Bayraktar, assistant professor at the XUV Optics Group.

The extreme ultraviolet light is emitted by a plasma source, produced by aiming lasers at metal droplets. With sets of special mirrors, this light is aimed at a silicon wafer to create the smallest microchips imaginable.

"We want to make the plasma as small as possible. Too large and you waste a lot of light because the mirrors cannot catch all the light," said Bayraktar.

In addition to the beam size, the emitted wavelength is also important. "The plasma does not only emit extreme ultraviolet light, but also other colors," said Bayraktar. With this new tool, the researchers can look at the size and wavelength simultaneously. This makes it possible to investigate the relation between the size of a plasma source and wavelength it emits.

For this new tool, the researchers used a combination of tapered zone plates and transmission grating. Both were produced at



Photo: MESA+ Institute.

The MESA+ Institute for Nanotechnology, part of the University of Twente, The Netherlands, has developed a tool that can measure the size of a plasma source and the wavelength of the light it emits simultaneously.

MESA+. Tapered zone plates are specialized optical components that manipulate extreme ultraviolet light to precisely image the plasma source. The transmission grating disperses the light into its individual colors, making it possible to individually measure them.



Netherlands startup SuperLight gains funding

SuperLight Photonics, a spin-off from the University of Twente, is developing a wideband laser that can serve as a light source in various measurement and detection applications.

On September 14th, the company announced the completion of a seed investment round, led by Dutch Deep Tech investor DeepTechXL in collaboration with Oost NL. With the investment, SuperLight Photonics plans to further develop its platform technology into products and systems. Financial details were not disclosed.

The wideband laser is based on the patented platform technology of SuperLight's founder Haider Zia. Zia was previously a researcher at Twente, specializing in integrated and nonlinear optics.

Superlight contends that "Unlike existing laser technology, we can use colors in light to transmit information. This technology has numerous potential applications, such as creating 3D images of eyes for opticians or aiding dermatologists in detecting skin cancer. Beyond the medical sector, laser technology can be used, for example, to detect small cracks in oil or gas pipelines or

to enhance optical safety sensors in smart cars."

CEO Cees Links commented, "Our mission is to leverage our platform technology with active support from our investors. We are aiming for a swift market entry, relying on the robust photonics ecosystem in the Netherlands and Twente.

"In the coming years, SuperLight is poised for significant growth, market establishment, and further scaling. We eagerly anticipate market responses to our upcoming product launches at the PIC Summit Europe photonics event on November 7th and 8th in Eindhoven."

Ron Maurer, partner at DeepTechXL, commented, "The [Superlight] technology aligns with our goals of achieving societal objectives such as faster, more cost-effective data generation and disease detection. In the long run, it could also contribute to more energy-efficient data exchange."

Jacob Issa, investment manager Tech at Oost, added, "SuperLight Photonics is a brilliant example of innovative entrepreneurship in synergy with knowledge institutions in Twente. Through Innovatiefonds Overijssel, a fund of the Province of Overijssel managed by Oost NL, we can contribute to the solid establishment and growth of a unique photonics company."

<https://optics.org/news/14/9/22>

Perovskite LEDs produced by penmanship

WUSTL, Washington, technique deposits flexible optoelectronic devices on everyday materials.

The potential advantages of perovskite materials for both light emission and absorption in optoelectronic devices have been clear for some time.

In photovoltaic devices, perovskites hold out the promise of greener alternatives to silicon solar cells, although manufacturing such materials at scale has remained challenging.

For light emission, perovskite-based LEDs may prove to be a route to low-cost, color-tunable approaches to device design for color displays and lighting, and for uses in optical communication applications.

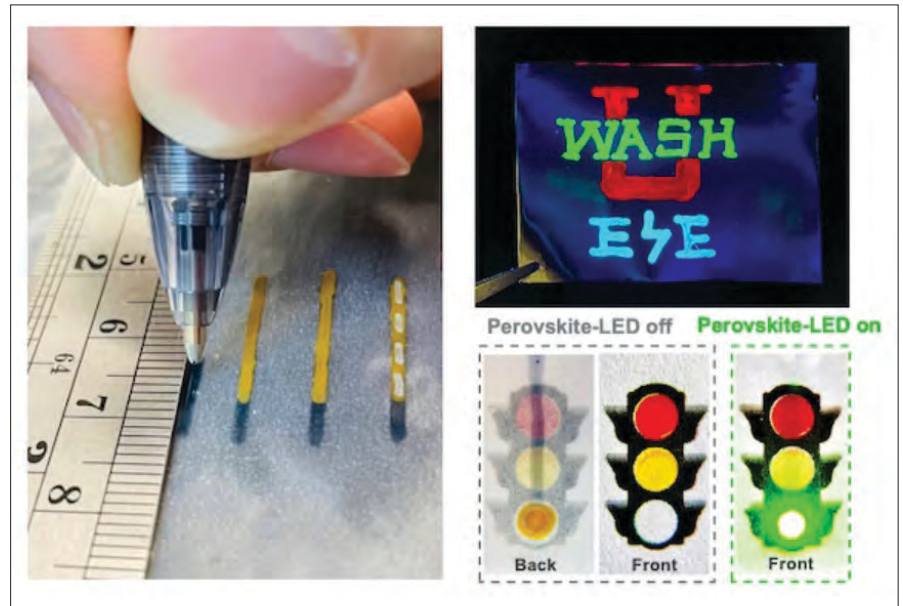
A project at Washington University in St. Louis (WUSTL) has now developed a method of depositing perovskite optoelectronic structures from handheld ink pens, leading to emitters being “written” by hand on flexible, stretchable materials.

Published in *Nature Photonics*, the findings could allow anyone to make a custom LED or photodetector without the need for any specialized training or bulky equipment.

The new handheld fabrication technology builds on earlier work by WUSTL studying how to create stretchable LEDs using a simple inkjet printer, depositing the optoelectronic materials required through the same principles that the printer uses to deposit pigment.

“Handwriting custom devices was a clear next step after the printer,” said WUSTL’s Chuan Wang. “We had the inks already, so it was a natural transition to take the technology we had already developed and modify it to work in regular ballpoint pens where it could be cheap and accessible to all.”

The project aimed to design handheld writing instruments filled with inks made of conductive polymers, metal nanowires and perovskite materials to generate a wide spectrum of emission colors. By building up layers of the functional inks with the pens,



Junyi Zhao demonstrates using a simple ballpoint pen to write custom LEDs on paper (left). The same pens can be used to draw multicolored designs on aluminium foil (top right) and to create light up sketches (bottom right).

a variety of functional devices including disposable electronics, smart packaging, and personalized biological sensors could be created cheaply, easily and quickly.

Clinical benefits for medical patients from handwritten devices

“Strategies for fabricating light-emitting diodes and photodetectors on different substrates are restricted in terms of their quantity and variety as strict flatness and smoothness are often required,” noted the project in its *Nature Photonics* paper. “Here we develop a highly versatile, scalable and eco-friendly handwriting approach to draw multicolour perovskite light-emitting diodes and perovskite photodetectors on various substrates.”

The translation of the principle from inkjet printer to handheld pen was not trivial, but once achieved means that devices built up from the ink materials could in theory be deposited on almost any substrate.

“Each single layer of the device is designed to be intrinsically elastic, so it will survive

deformation and can be bent, stretched and twisted without impacting device performance,” commented researcher Junyi Zhao. “For example, LEDs drawn on a glove could tolerate deformations from repeated fist grasping and releasing, and LEDs drawn on a rubber balloon could survive inflation-deflation cycles over and over.”

Creation of LEDs on substrates as varied as fabric and party balloons would potentially overcome limitations of traditional LED fabrication, particularly the requirement of flat, smooth substrates and costly clean-room fabrication equipment. It could ultimately assist next-generation wearable electronics to become widespread in daily life.

Chuan Wang envisions future applications for handwritten electronics ranging from educational purposes and science popularization to electronic packaging, from clothing to medical sensors and bandages.

“One area we’re really excited about is medical applications,” Wang said. “Handwritten light emitters and detectors allow more patient-specific flexibility in creating wearable biomedical sensors and bandages that could have photodetectors and infrared LEDs drawn onto them, for measuring pulse oximetry or to speed wound healing.”

<https://optics.org/news/14/8/24>

Credit: Wang Lab/WUSTL.

Novel 3D glass printing method works without sintering

Low-temperature process developed at KIT delivers a variety of high-resolution optics products.

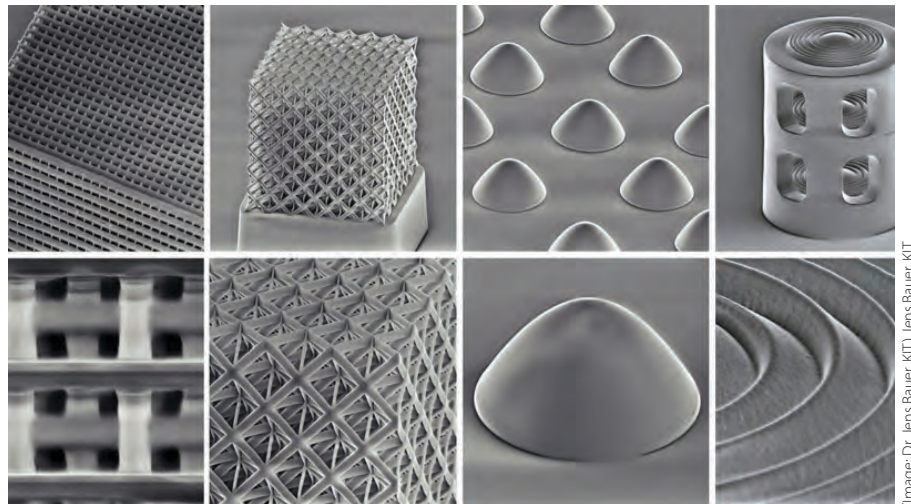
A new 3D glass printing process developed at Karlsruhe Institute of Technology (KIT), Germany, produces nanometer-fine quartz glass structures that can be printed directly onto semiconductor chips.

A hybrid organic-inorganic polymer resin serves as the starting material for the 3D printing of silicon dioxide. Since the process does not require sintering, the temperatures required are significantly lower. At the same time, higher resolution enables nanophotonics with visible light. The work is described in *Science*.

The printing of quartz glass made of pure silicon dioxide in micro- and nanometer-fine structures opens up new possibilities for many applications in optics, photonics and semiconductor technology. However, until now, techniques based on traditional sintering have dominated.

The temperatures required for the sintering of silicon dioxide nanoparticles are over 1,100 degrees Celsius – far too hot for direct deposition on semiconductor chips. A research team led by Dr. Jens Bauer from the KIT Institute of Nanotechnology (INT) has now developed a new process to produce transparent quartz glass with high resolution and excellent mechanical properties at significantly lower temperatures.

Bauer, who heads the Emmy Noether junior research group “Nanoarchitected Metamaterials” at KIT, and his colleagues from the University of California Irvine and the medical technology company Edwards Lifesciences in Irvine present the method in the journal *Science*.



(Image: Dr. Jens Bauer, KIT) Jens Bauer, KIT

With the new process, a large variety of quartz glass structures can be produced on a nanometer scale.

Hybrid organic-inorganic polymer resin

A specially developed hybrid organic-inorganic polymer resin serves as the starting material. This liquid resin consists of so-called polyhedral oligomeric silsesquioxane molecules (POSS): tiny cage-like silicon dioxide molecules are equipped with organic functional groups.

Once formed, the fully 3D printed and networked nanostructure is heated in air to a temperature of 650 degC. In the process, the organic components are expelled and, at the same time, the inorganic POSS cages combine, resulting in a continuous fused silica micro- or nanostructure. The required temperature is only half that of processes based on the sintering of nanoparticles.

“The lower temperature makes it possible to print robust, transparent and free-form optical glass structures directly onto semiconductor chips with the resolution required for visible-

light nanophotonics,” explains Bauer. In addition to the excellent optical quality, the quartz glass produced in this way has excellent mechanical properties and is easy to process.

The team from Karlsruhe and Irvine printed many different nanoscale structures with the POSS resin, including photonic crystals of free-standing 97-nanometer beams, parabolic microlenses, and a multilens microlens

with nanostructured elements. “Our process enables structures that also withstand difficult chemical or thermal conditions,” said Bauer.

“The group at INT headed by Jens Bauer belongs to the Cluster of Excellence 3DMM2O,” said Professor Oliver Kraft, VP Research at KIT. “The research results now published in *Science* are just one example of how well the consistent promotion of young talent within the cluster works.”

The 3D Matter Made to Order cluster of excellence, a joint cluster of KIT and Heidelberg University, is combination of natural and engineering sciences a strongly interdisciplinary approach. His goal is to take 3D additive manufacturing processes to the next level – from the molecular level to macroscopic dimensions.

www.kit.edu

<https://optics.org/news/14/6/13>

G&H snaps up polymer component specialist GS Optics

Expansion planned at GS Optics' downtown Rochester headquarters following \$15.7M deal.

London-listed Gooch & Housego (G&H) has acquired US firm GS Optics, a specialist in polymer optical components, in a cash-plus-stock deal worth up to \$15.7 million.

Originally founded as Germanow-Simon Corp. in 1916, GS Optics (also known as GS Plastic Optics) now employs around 60 people at its site in downtown Rochester, where it manufactures injection-molded polymer optical components, including freeform imaging optics and mirrors.

GS Optics is also said to have well-established in-house capabilities to provide custom-designed, diamond-turned and injection-molded prototypes, as well as thin-film anti-reflective and reflective coatings, and integrated optical solutions.

Rochester hub set for expansion

G&H says that it plans to invest in the Rochester campus, establishing it as the company's wider center of excellence for life sciences applications in North America.

"GS Optics will become the G&H innovation hub for dynamic, high-performing teams and cutting-edge research, development, and manufacturing of optics and photonics for life sciences," announced G&H.

The UK company specified that there were "no planned job losses", and that it would "immediately" expand the Rochester site by 25 per cent to support its growth plans.

"GS Optics has established itself as a leader in polymer optics, with a strong presence in the medical diagnostics sector," G&H added in a regulatory filing detailing the deal.

"Combining the capabilities of GS Optics with the global reach of G&H's commercial and engineering teams will accelerate [G&H's] growth in optical solutions for the life sciences market and some specific [aerospace and defense] and industrial applications."

Specific market areas in life sciences include ophthalmic lenses, surgical imaging, and diagnostic instrumentation, as well as military and civilian night-vision and visible-range sighting applications.

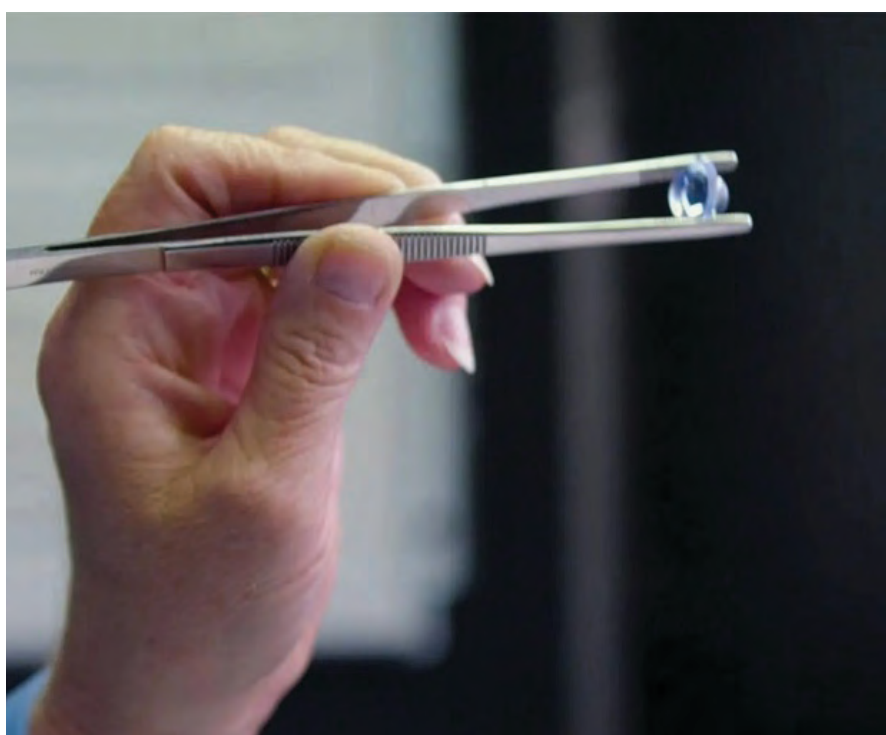


Photo: G&H/GS Optics.

Founded more than a century ago, GS Optics specializes in the custom manufacture of precision polymer optics - typically for use in life sciences and military night-vision applications. G&H has acquired the Rochester-based company in a deal worth up to \$15.7 million.

G&H CEO Charlie Peppiatt said of the acquisition: "GS Optics is a high-quality business with a strong customer base and differentiated technology. The acquisition is in line with our recently announced new strategy to become an innovative customer-focused technology company."

\$10M turnover in 2022

Andy Germanow, the GS Optics CEO, added: "Joining forces with G&H is a tremendous opportunity for us. We have always strived to deliver the highest quality optics to our customers, and this acquisition opens up new horizons.

"As part of G&H, we will leverage their extensive resources, expertise, and global

presence to accelerate our growth and continue providing innovative solutions to our customers."

Under the terms of the deal, G&H have paid an initial cash sum of \$11.3 million, augmented by \$2.6 million of new G&H ordinary shares. A further \$1.8 million in cash could be payable, depending on how the GS Optics business performs this year.

In 2022, the Rochester firm is said to have realized earnings before interest, tax, depreciation and amortization (EBITDA) of approximately \$1.5 million on sales of around \$10 million - meaning that it

should slightly enhance G&H's current profitability.

Earlier this year G&H posted an adjusted pre-tax profit of £4.5 million after its sales in the six months to March rose sharply, to £71.3 million.

Outlining the results of the recent strategic review at the time, CEO Peppiatt said the firm would pursue "speed to value" acquisitions that filled a gap in its existing portfolio.

Following completion of the deal, GS Optics will be branded under the G&H umbrella, and known as "G&H | GS Optics".

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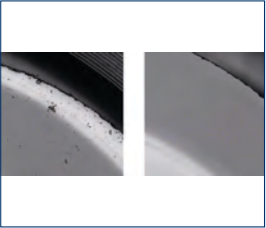
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CO2 Telescope Unit K1-05-LV

Applied Surface Technologies is introducing a new unit aimed at particle removal applications. The K1-05-LV is aimed for astronomers that wish to clean their optics with the lens and mirrors within the telescope.

The same unit can be used before thin film coating or cleaning optical insert mold before application. This unit is discussed at <https://www.co2clean.com/telescopes>.

The unit is easily upgraded to perform particle, hydrocarbon, and organic removal. Particle removal covers the entire range from visible to nanometers. Hydrocarbon and organic (even solvent) removal is as effective as solvents.



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