Top Interview

QD Laser,Inc.

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A series of new products for early detection of eye diseases and visual aids

"Unlike physical changes that appear on the face, it was difficult for other people to notice changes in the eye. But those changes can be readily identified with this, "expressed the president of a taxi company, who was impressed by the "MEOCHECK," a simple perimeter resembling a microscope. Drivers look into the device with one eye at a time, and in about one minute, it can determine with a high degree of accuracy the possibility of glaucoma, which causes a lack of vision, or cataracts, which obstruct night vision. Compared to optometry equipment operated by medical professionals at hospitals and elsewhere, it is smaller, less expensive, and can perform examinations in a shorter time.

In a test operation conducted on roughly 100 drivers earlier this year, some were found to have brain tumors or eye diseases requiring medical attention, which prompted the taxi company to take measures to ensure safer working conditions, including medical treatments and a shift to daytime working hours. The company will continue to use MEOCHECK for routine checkups and follow-up observations.

"People's eyes are considered to be healthy until they turn about 60, and the average age of the nearly 300,000 taxi drivers in Japan is over 60. In other words, it could be that there are many drivers that have some vision trouble, despite the fact that reliable vision is essential for safety in driving jobs. Therefore, we would like to promote the early detection of eye diseases by popularizing the simple perimeter and improving its functions while linking it to other vital data and smartphone apps, so that people can keep healthy and refer themselves to doctors."

So says Dr. Mitsuru Sugawara, President and CEO of QD Laser, Inc., the developer of MEOCHECK. The company has long been known for its eyeglass-type visual aids and assistive devices (laser eyewear, released in 2018) that utilize its proprietary laser retinal projection technology, and has now expanded its product lineup using the same technology.

Laser eyewear is expected to be adopted by more than five million people in Japan, the U.S., and Europe. The company expects sales of 100,000 units for the next model, which is being developed jointly with an electronics manufacturer and is positioned to be quite popular. In addition, the viewfinder "Super Capture" is scheduled for release soon, and will be offered as an optional device for digital cameras, making it possible for visually impaired users to see easier.

In the corporate market, in addition to MEOCHECK which is being marketed toward companies such as taxi operators within the transportation industry, ONHAND, a new type of compact, handheld magnification reading

device with a wide field of view, is steadily receiving requests for replacements from customers including public libraries.

Unique technology to deliver images directly to the retina

The laser, which the company has named "VISIRIUM Technology," is used in laser retinal projection technology, and is a type of artificially produced light.

The laser emits light of a specific color in a straight line, and even though the light hits the cornea or lens of the naked eye, it can travel straight ahead and reach the retina in the fundus of the eye, which responds to light. In other words, even in the presence of eye diseases such as cataracts and refractive errors that impair the function of the lens of the eye, or glaucoma and age-related macular degeneration, in which part of the retina is dysfunctional, this laser can aim at the normal part of the retina and directly deliver color.

The laser light is aimed at the pupil in primary colors (red, green, and blue) at a very low level so that it can be safely viewed, and moves rapidly to draw "dots" on the retina which results in a composite afterimage that restores one's clear vision. It is also possible to check for areas that are not visible or less visible in a very short period of time by projecting several dots over the entire field of vision in a similar manner.

These various QD Laser products all combine a variety of their own technologies that manipulate light according to these principles, and embody functions that meet actual needs and scenarios for use. The company began developing products related to eye health in 2012, seven years after its founding. It took the opposite approach to normal laser research, which pursues high output power, and explored the use of lasers that are weak enough to be seen directly, which led to many people with visual impairments responding that they could see.

Now, retinal projection technology is gaining attention of investors as a socially conscious investment, or the "S" in ESG, a business area that can help solve social issues around the world.

The source of competitiveness is "top secret"

In addition to VISIRIUM technology which contributes to our health and safety, the company's semiconductor laser development and supply business for industrial applications such as laser processing, communications, inspection equipment, and sensors currently account for 90% of its sales. Of particular note is the company's mass production technology for quantum dot (QD) lasers, from which the company's name "QD Laser" is derived.

Quantum dots are microparticles that can trap electrons inside and block any unnecessary movement. When they are applied to semiconductors, temperature stability and power efficiency significantly improve. In QD Laser's quantum dot lasers, approximately one million dots are uniformly dispersed inside a laser chip. The chip is less than one millimeter on each side and is cut from a semiconductor wafer produced in-house.

The company is the only manufacturer in the world capable of mass-producing quantum dot wafers and laser chips. The specific manufacturing process is top secret; the company has not even applied for a patent for this technology, making it completely confidential.

Dr. Sugawara explains the significance of startups having unparalleled proprietary technologies and the impact they have on society.

"Although semiconductor manufacturers in emerging countries have increased their presence, the field of semiconductor lasers requires both advanced knowledge of physics and sophisticated manufacturing technologies, so it is still dominated by Japan, the United States, and European countries. In addition, the major players in this field are large manufactures that only target markets of larger than JPY 100 billion. In this environment, our company of about 60 employees continues to take on the challenge of an untapped market that is large enough by introducing to the world devices such as quantum dot lasers, which cannot be made by even leading manufactures, and products based on these devices.

Although semiconductor devices are generally considered to be heat sensitive, quantum dot lasers can function normally at temperatures up to about 200 degrees Celsius, and are stable enough to maintain their output without adjustment from -40 degrees to over 100 degrees. So, for example, if quantum dot lasers could be applied to signal transmissions inside computers, the speed of light,

which far exceeds that of electricity, could be used in harsh environments, greatly improving the performance of computer information processing."

Spin-off from the laboratories. 'Researchers and corporate managers do the same.'

Dr. Sugawara says he has loved mathematics since childhood. His father was a doctor at a university hospital, but he was "not fond of the sight of blood" and was rather attracted to quantum mechanics and other fields of physics that lean more toward fundamental research. He then became interested in materials that exhibit unique physical properties, and by the time he started his master's degree program at the University of Tokyo's Graduate School of Engineering, he recalls that he "started to study superconductors that have no electrical resistance, mixing and applying heat to metals [he] bought for daily measurement".

After finishing graduate school in 1984, he joined Fujitsu Laboratories Ltd., a world leader in semiconductor materials research. Since then, he has spent more than 20 years immersed in research, diligently publishing papers.

Dr. Sugawara led a research project on the practical application of new materials for optical communication devices, during which the laboratories discovered quantum dots and successfully created a laser in 1995. By the time he assumed a key position in a research project in the early 2000s, various technologies needed to deliver light inside IC chips using quantum dot lasers were almost all in place.

However, the future of the company's research system suddenly became uncertain, due to the company's policy change following the burst of the IT bubble. With the support of the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Economy, Trade and Industry, the company was able to survive for several years through joint research with the University of Tokyo, but the technology that had been so carefully perfected was not put into practical use.

Ultimately, Dr. Sugawara decided to start a business, something he had never previously considered. He established and became president of QD Laser in April 2006 with investment from the venture capital firms Fujitsu and Mitsui. He decided to create a business based on this previous research, as he thought, "we should not miss the opportunity to put it to practical use. With the support of the government, we should fulfill our responsibility to share the results of our research."

Incidentally, while Dr. Sugawara founded his company at the age of 47, most of his 40 colleagues who joined the laboratories in the same year as he did had moved to universities or other institutions to continue their research careers. While it is not unusual in the U.S. for career entrepreneurs to launch high-tech companies in their 40s, Dr. Sugawara seems to be a pioneer by doing so in Japan. When he was asked if he had any hesitations, his response was surprisingly simple: "Researchers and corporate managers do the same thing."

"Corporate managers set goals, understand problems, find the key points solving them, and repeat the process of trial and error to explore specific measures. At the same time, they seek the money, people, and partners to implement them. When I think back to that time, these are exactly the same things I used to do as a researcher when writing papers. Therefore, I think the system in Silicon Valley, where engineers with PhDs are actively starting businesses, makes a lot of sense, and we will see more and more researcher-led startups going public in Japan in the future."

Listen to voices of every potential customer based on the trust gained through listing

No matter how unprecedented a technology may be, it will only become valuable when it meets real-world needs. QD Laser has been refining its own laser technologies. How has it built its business, applying these technologies in the real world? Dr. Sugawara explains.

"We are the only company in the semiconductor laser industry that has adopted a 'semi-fabless' model in which we outsource processing and assembling while having the expertise and facilities to manufacture materials that can handle all wavelengths of light. This is because we believe that 'horizontal specialization' is important for concentrating on areas where we have strengths. It is largely due to this framework that we can handle a fairly wide range of products for a company of our size.

QD Laser's strength lies in its laser materials and design technology that manipulates the light emitted by those materials. In order to leverage these strengths to develop new products, we first make plans for a tentative product, then ask various potential users whether this would be something they would use. It is unlikely that we would find a user who wants these tentative products straight away, but knowing why our plans are wrong leads us to the next step. It is just like conducting experiments in the real world."

In February 2021, the company was listed on TSE Mothers (current Growth Market) to raise funds for the expansion of its VISIRIUM technology-related business. Dr. Sugawara commented on the benefits of listing. "The largest benefit of listing was that we gained trust as a listed company in developing businesses related to healthcare, and our proposals and sales were no longer immediately rejected. In addition to our laser eyewear having obtained approval as a medical device, we now receive more requests for advice from startups aiming to enter the medical field."

Now that the company has been listed, the range of places from where we can receive feedback has expanded, and a virtuous cycle has been created in which the company's track record with its renowned partners attracts partners for the next collaboration, for example, with Santen Pharmaceutical, known for its ophthalmic drugs, and SEED, known for its contact lenses to sell our laser eyewear, and with Sony for the commercialization of a viewfinder. Dr. Sugawara further states, "during the preparation process for listing, I read the Corporate Governance Code until I could recite it by heart. It was very helpful in strengthening our internal systems."

Dr. Sugawara's academic character and thorough research is not limited to his work as president; he also enjoys playing the piano and holds a concert every year, the 20th anniversary of which will be held at the end of this year. However, his greatest interest is still his work. He has high hopes for the mass production of quantum dot lasers, which will start next year, and the implications it will have for the world.

"We will finally achieve the goals we set when QD Laser was founded: to use a quantum dot laser to deliver information to computer chips by light and to meet the demand for communications that will increase 100 to 1,000 times every ten years. The next-generation mobile communication system 6G is expected to be widely used around 2030. This will require technology that can instantly process image data from dozens of cameras installed in one autonomous vehicle, and major semiconductor manufacturers have already developed circuits that can calculate and store data using light which has a higher transmission speed than electricity. Since the circuits themselves do not emit light, the light must be drawn in from an outside source. Only our quantum dot lasers can deliver that light directly to the circuits. I think we can definitely win against our competitors' methods for sending lasers from external sources through optical fibers.

Even when the world's 6G communication base stations adopt quantum dot lasers, we will be able to supply almost all the materials needed with our established expertise and by expanding our existing facilities. We currently provide prototypes to about 10 telecom-related semiconductor manufacturers in various countries and look forward to the day when we can announce that they will officially use our products."

Vividly depicting a world as yet unseen and making it a reality. The true potential of the laser is about to be unleashed.

2022/08/25

Profile

Dr. Mitsuru Sugawara
President and CEO
QD Laser, Inc.

1958	Born in Niigata
1984	Graduated with a master's degree in applied physics from the School of Engineering, University of Tokyo, and entered Fujitsu Laboratories Ltd.
1995	Became a senior researcher at Fujitsu Laboratories' optical semiconductor devices laboratory and earned a Ph.D. in engineering from the University of Tokyo
1999	Became a guest associate professor at the Tokyo Institute of Technology's Department of Electronics and Functional Systems (concurrent position)
2001	Appointed manager of Photo Novel Technology Research at Fujitsu Laboratories
2004	Became a professor at the Institute of Industrial Science, University of Tokyo
2005	Became the deputy manager of Fujitsu Laboratories' Nanotechnology Research Center
2006	Became president and CEO of QD Laser, Inc. (current position)