Annual Technical Report 2022

FY2022 OITDA

Optoelectronics Industry and Technology Development Association

— C O N T E N T S —

Message from OITDA

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We are pleased to present here a technical information report summarizing the surveys and R&D activities conducted by OITDA in FY2022.

First, let us look at the overall trends in the optoelectronics industry from the FY2022 survey. The total shipment value of the optoelectronics industry increased from +0.3% in FY2021 to +8.5% in FY2022, totaling 12,643 billion yen, while the domestic production value increased significantly from -0.2% in FY2021 to +6.2% in FY2022, totaling 6,206 billion yen. Most of the fields are expanding, with the Optical Input/Output field expanding by +23.5%, a remarkable increase due to the rise of image sensors, surveillance and vehicle-mounted cameras, and mirrorless single-lens digital cameras. The Optical Communications field has increased by +10.4% and has grown annually for the past four years due to the surge in information traffic. The Sensing/Measurement field has also increased by +8.7% and has grown for the fifth year in a row due to a rise in demand for IoT and other applications. The Laser/Optical Processing field rebounded significantly, up +23.5% in FY2021 and +10.0% in FY2022. The Photovoltaic Energy field has grown by +3.8%.

Next, I would like to introduce some items of special note for FY2022, while detailed activities and results of individual projects by OITDA in FY2022 can be found in the rest of this report.

We established a special committee under the Technology Strategy Development Committee to create a "Technology Roadmap for Applying Visible Light Semiconductor Lasers to Achieve Carbon Neutrality" in anticipation of demand for new applications. These include integrated systems of displays, lighting, and indoor visible light communications, long-distance visible light communications, blue laser processing, and agricultural applications. The results of these were presented at the Symposium on the Optoelectronics Industry and Technology held on February 8, 2023.

In the area of standardization, we used projects commissioned by the Ministry of Economy, Trade and Industry (METI) to promote projects that include the development of evaluation technologies for international standards, such as for multicore fiber optical connectors, automotive Ethernet systems, and optical disks for archiving. The last two themes were successfully completed, thus achieving our initial goals. In addition, we actively participated in international standardization by the IEC, ISO, and in various forums, including ISO/TC 172/SC 9, and IEC/TC 76, which serve as the domestic secretariat. Furthermore, for the first time in three years, we were able to hold a laser safety school and laser equipment handling technician exams in a face-to-face setting.

For the feasibility study project, we conducted leading research and strategic planning surveys on two themes: Integrated LIDAR Sensors for Air Mobility and Market Development of Optical Wireless Power Transmission Systems for Small Mobile Devices.

In terms of technological development, the project for High-Efficiency, High-Speed Processing Distributed Computing System Using Heterogeneous Material Integrated Optoelectronics, which was launched in FY2021 as a NEDO commissioned project based on leading research conducted by OITDA, is being implemented at the Photonics Electronics Technology Research Association (PETRA). Another project conducted based on our leading research is the Research and Development of High Speed and Low Power Data Transfer System Using Photonic & Electronic Hybrid Switch, which reached its final year in FY2022. Efforts are now underway to put spatial switches and burst-capable optical digital coherent transceivers, which were developed as a result of this project, into practical use.

The OITDA is promoting the development of R&D and commercialization strategies, including the above-mentioned technologies, as the cornerstone of industry-academia-government collaboration related to optoelectronic industrial technology. We are also implementing projects in FY2023 on key issues related to optoelectronic industrial technology. These issues include surveys and research, promotion of technological development, and promotion of standardization. Under the direction of METI and other government agencies, we are committed to enhancing and strengthening our business activities to meet the needs of our members, with the cooperation and understanding of many people in industry, including supporting members, and academia, an important partner.

We wish you good health and look forward to your continued guidance, support, and cooperation.

Optoelectronics Industry Trends

1. Introduction

OITDA has conducted the "Survey of Trends of the Optoelectronics Industry" annually since its foundation in 1980. The accumulated survey data of more than 40 years is highly regarded as the basic source for trends of the Japanese optoelectronics industry.

This year, we have set seven research subcommittees under the "Optoelectronic Industry Trends Investigation Committee" and conducted a survey for the statistical data from FY 2021 to FY 2023, including the shipment value and domestic production value of the entire Japanese optoelectronic industry.

2. Total Shipments and Domestic Production for the Optoelectronics Industry

2.1 Survey Method

We conducted a questionnaire survey of the domestic companies producing optical-related products (optical equipment/systems and components) on the results of FY2021 (actual), FY2022 (estimate), and FY2023 (qualitative prediction) for total shipments (including overseas production) and domestic production. The questionnaires were sent to 201 companies in October 2022 and collected between December 2022 and February 2023. Responses were obtained from 82 companies.

Regarding the prediction for the next fiscal year, a quantitative survey had been conducted until FY2010, but the accuracy and reliability was not sufficient thereafter. Therefore, it has changed to a qualitative survey since FY2011. Specifically, the evaluation was made on a five-point scale: increase, little increase, flat, little decrease, and decrease, compared to the previous year.

We received the cooperation of the Japan Photovoltaic Energy Association (JPEA) for the Photovoltaic field, the Japan Lighting Manufacturers Association (JLMA) for the Solid-state Lighting field, the Japan Electronics and Information Technology Industries Association (JEITA) for the Display field, and the Imaging Products Association (CIPA) /Fuji Chimera Research Institute Inc. for the Input/Output field.

Based on the survey, we have compiled the total shipments and domestic production in the optical industry in Japan as a whole by conducting data validity examinations and industrial trend analysis by each specialized subcommittee for each product field, and the Optoelectronic Industry Trends Investigation Committee has rechecked the validity of the data and analysis results.

For the survey, we classified the optoelectronics industry, together with relevant optical equipment/systems and components, into the seven fields shown below.

1. Optical Communication:	Optical transmission equipment/systems, optical fiber fusion splicer, light emitting devices, photo detectors, optical passive components, optical fiber, optical connectors, etc.
2. Optical Storage:	Optical disc equipment (read-only, recordable), optical disc media, laser diodes, etc.
3. Input/Output (I/O):	Optical printers, multifunction printers, digital cameras, digital video cameras, camera mobile phones, image sensors, surveillance cameras, and car-mounted cameras
4. Display/Solid-state Lighting:	Flat panel display devices and equipment, projectors, solid-state lighting devices and equipment, LED (for lighting and displays), etc.
5. Photovoltaic Energy:	Photovoltaic power generation systems, photovoltaic cells and modules
6. Laser/Optical Processing:	Laser/optical processing equipment, lamp/LD lithography, additive manufacturing (3D printers), laser oscillators
7. Sensing/Measuring:	Optical sensing equipment, optical measuring instruments
8. Others:	Hybrid optical devices, etc.

2.2 Overview of Survey Results of Total Shipments

Table 1 shows the results of FY 2021 (actual), FY 2022 (estimate) and FY 2023 (prediction) for total shipments.

●FY 2021 (actual): 11,650 billion yen, growth rate: +0.3%

In FY2021, total shipments (actual) for the optoelectronics industry amounted to 11,650 billion yen (growth rate: 0.3%). This breaks down as: 7,720 billion yen for optoelectronics equipment/systems (growth rate: -2.2%; composition ratio: 66.3%) and 3,930 billion yen for optical components (growth rate: 5.7%; composition ratio: 33.7%)

The shipments by field were:

538 billion yen for the Optical Communication field (growth rate: 0.8%; composition ratio: 4.6%), 444 billion yen for the Optical Storage field (growth rate: -13.9%; composition ratio: 3.8%), 3,131 billion yen for the I/O field (growth rate: 7.1%; composition ratio: 26.9%), 4,630 billion yen for the Display/Solid-state Lighting field (growth rate: 0.8%; composition ratio: 39.7%), 1,756 billion yen for the Photovoltaic Energy field (growth rate: -15.4%; composition ratio: 15.1%), 759 billion yen for the Laser/Optical Processing field (growth rate: 23.5%; composition ratio: 6.5%), and 301 billion yen for the Sensing/Measuring field (growth rate: 12.2%; composition ratio: 2.6%).

●FY 2022 (estimate): 12,643 billion yen, growth rate: 8.5%

Total shipments for the optoelectronics industry in FY2022 are estimated to be 12,643 billion yen (growth rate: 8.5%). This breaks down as: 8,465 billion yen for optoelectronics equipment/systems (growth rate: 9.7%; composition ratio: 67.0%) and 4,177 billion yen for optical components (growth rate: 6.3%; composition ratio: 33.0%).

The shipments by field are estimated to be 594 billion yen for the Optical Communication field (growth rate: 10.4%; composition ratio: 4.7%), 498 billion yen for the Optical Storage field (growth rate: 12.2%; composition ratio: 3.9%), 3,866 billion yen for the I/O field (growth rate: 23.5%; composition ratio: 30.6%), 4,601 billion yen for the Display/Solid-state Lighting field (growth rate: -0.6%; composition ratio: 36.4%), 1,824 billion yen for the Photovoltaic Energy field (growth rate: 3.8%; composition ratio: 14.4%), 835 billion yen for the Laser/Optical Processing field (growth rate: 10.0%; composition ratio: 6.6%), and 327 billion yen for the Sensing/Measuring field (growth rate: 8.7%; composition ratio: 2.6%).

●FY 2023 (prediction): flat

The total shipments of the optoelectronic industry in FY2023 are expected to be flat. Likewise, the shipments for optical equipment/systems and optical components are also expected to be flat.

The expectations for shipment values are as follows: little increase for I/O field, Laser/Optical Processing field and Sensing/Measuring field; flat for Optical Communication field, Optical Storage field, Display/Solid-state Lighting field and Photovoltaic Energy field.

2.3 Overview of Survey Results of Domestic Production

Table 2 shows the results of FY 2021 (actual), FY 2022 (estimate) and FY 2023 (prediction) for Domestic Production.

●FY 2021(actual): 5,842 billion yen, growth rate: -0.2%

In FY2021, the domestic production of the optoelectronics industry (actual) was 5,842 billion yen (growth rate: -0.2%). This breaks down as 3,434 billion yen for optoelectronics equipment/systems (growth rate: -3.7%; composition ratio: 58.8%) and 2,408 billion yen for optical components (growth rate: 5.3%; composition ratio: 41.2%).

The domestic productions by fields were:408 billion yen for the Optical Communication field (growth rate: -1.3%; composition ratio: 7.0%), 23 billion yen for the Optical Storage field (growth rate: -43.8%; composition ratio: 0.4%), 972 billion yen for the I/O field (growth rate: 3.8%; composition ratio: 16.6%), 2,163 billion yen for the Display/Solid-state Lighting field (growth rate: 3.9%; composition ratio: 37.0%), 1,216 billion yen for the Photovoltaic Energy field (growth rate: -19.1%;

composition ratio: 20.8%), 736 billion yen for the Laser/Optical Processing field (growth rate: 23.2%; composition ratio: 12.6%), and 238 billion yen for the Sensing/Measuring field (growth rate: 14.6%; composition ratio: 4.1%).

●FY 2022 (estimate): 6,206 billion yen, growth rate: 6.2%

The domestic production of the optoelectronics industry in FY2022 is estimated to be 6,206 billion yen (growth rate: 6.2%). This breaks down as 3,716 billion yen for optoelectronics equipment/systems (growth rate: 8.2%; composition ratio: 59.9%) and 2,490 billion yen for optical components (growth rate: 3.4%; composition ratio: 40.1%).

The domestic productions by fields were 456 billion yen for the Optical Communication field (growth rate: 11.7%; composition ratio: 7.3%), 26 billion yen for the Optical Storage field (growth rate: 15.5%; composition ratio: 0.4%), 1,217 billion yen for the I/O field (growth rate: 25.3%; composition ratio: 19.6%), 2,077 billion yen for the Display/Solid-state Lighting field (growth rate: -4.0%; composition ratio: 33.5%), 1,265 billion yen for the Photovoltaic Energy field (growth rate: 4.1%; composition ratio: 20.4%), 813 billion yen for the Laser/Optical Processing field (growth rate: 10.4%; composition ratio: 13.1%), and 257 billion yen for the Sensing/Measuring field (growth rate: 7.6%; composition ratio: 4.1%).

●FY 2023 (prediction): flat

The domestic production of the optoelectronic industry in FY2023 is expected to be flat. Likewise, the production for optical equipment/systems and optical components are also expected to be flat.

The expectations for production values are as follows:

little increase for Optical Storage field, Display/Solid-state Lighting field, Laser/Optical Processing field and Sensing/Measuring field; flat for Optical Communication field, I/O field and Photovoltaic Energy field.

2.4 Trend in Optoelectronics Industry

Figures 1 and 2 show changes in the total shipment value of the optoelectronics industry and trends in each field, respectively. Figures 3 and 4 show changes in the domestic production value of the optoelectronics industry and changes by field, respectively. Figure 1 and 3 also show nominal GDP and electronic industry production in order to compare changes in the scale of the optoelectronics industry with those of the Japanese economy and other industries.

Japan's optoelectronic industry has continued to grow for a long period of more than 20 years since the survey started in FY1980, although there was a temporary decline due to the burst of the dot-com bubble. However, it became negative due to the impact of the financial crisis in FY2008. In addition, the tough situation continued due to the impact of the Great East Japan Earthquake in FY2011. After that, it turned to be positive due to the rapid growth in the Photovoltaic Energy field.
However, after peaking in FY2014, the Photovoltaic Energy field showed a significant downward trend, and the production of the entire optoelectronic industry decreased in FY2015 and FY2016 for the second consecutive year. In FY2017, it was expected to be almost flat and bottom out, but the downward trend continued after FY2018.
Moreover, in FY2020, the optoelectronic industry suffered great damage due to the COVID-19 pandemic.

In FY2021, there was an overall recovery trend, and in FY2022, it is expected that there will be positive growth.

The following is a summary of the survey results of this year and analysis for financial year.

●FY2021 (actual)

In the Input/Output field, products such as image sensors and imaging equipment recovered partly because of a rebound from FY2020, resulting in a significant increase in both total shipments and domestic production. Owing to a recovery in capital investments, primarily in the semiconductor and automotive industries, the total shipments and domestic production in the Laser/Optical Processing field increased significantly, while those in the Sensing/Measuring field increased modestly, primarily for optical sensing equipment. In the Display/Solid-state Lighting field, both total shipments and domestic production increased marginally. This is due to a rebound in LED lighting equipment, which showed a decline in FY2020, and an increase in demand for display devices, which have consistently shown negative growth, fueled by 5G terminals and other products. In the Optical Communications field, optical fiber and optical connectors performed well against the backdrop of increased demand for 5G systems and data centers, while optical devices declined due to supply shortages of semiconductor devices and other components, levelling total shipments and domestic production. Demand for consumer use in the Optical Storage field continued to decline, as did total shipments and domestic production. Due to shortages in supply of power semiconductors and other devices, the Photovoltaic Energy field experienced a decline in both total shipments and domestic production. The optoelectronics Industry as a whole shows a recovering trend, but total shipment and domestic production were flat due to a number of factors, such as component supply shortages caused by the spread of COVID-19.

Overall, total shipments for the optoelectronics industry totaled 11,650 billion yen with -0.3% growth rate, while domestic production totaled 5,842 billion yen with a -0.2% growth rate.

●FY 2022 (estimate)

In the Input/Output field, both total shipments and domestic production are expected to increase significantly due to increased demand for image sensors for automotive and other applications, mirrorless single-lens digital cameras with higher prices, and printers and MFPs for satellite offices and other uses. Both total shipments and domestic production in the Laser/Optical Processing field are expected to rise in tandem with rising capital expenditures, especially in the semiconductor and automotive industries. In the Sensing/Measurement field, both total shipments and domestic production are expected to show a somewhat modest increase, similar to the previous year. The Optical Storage field is expected to show an increase in total shipments and domestic production due to increased demand for playback-only equipment for game consoles. The Photovoltaic Energy field is also expected to see an increase in total shipments and domestic production due to the strengthening of policies to expand the introduction of photovoltaic power generation and the trend to prevent prices from falling. In the Optical Communications field, in addition to an increase in demand for 5G systems and data centers, the supply shortage of components such as semiconductors will be resolved, leading in an increase in both total shipments and domestic production. Optical transmission equipment and devices will also see higher demand, as well as optical fibers and other components. In the Display/Solid-state Lighting field, flat panel displays and LED lighting equipment will perform well, whereas display devices will decline, and as a whole, both total shipments and domestic production are expected to remain unchanged. In the optoelectronics industry as a whole, both total shipments and domestic production are expected to increase as the effects of component supply shortages and other factors subside.

The total shipment value of the optoelectronics industry is expected to reach 12,643 billion yen, an 8.5% growth rate, and the domestic production value is expected to reach 6,206 billion yen, a 6.2% positive growth rate.

●FY 2023 (prediction)

Due to a rise in demand for image sensors, imaging equipment, and printers/multifunction devices, our prediction for the Input/Output field indicate a slight increase in total shipments and a flat domestic production. In the Laser/Optical Processing and Sensing/Measurement

Table 1 Shipment of Optoelectronics Industry

Product Items	FY 2020 Shipment Actual (in 100 million yen)		FY 2020 Grow th Rate(%)	FY 2021 Shipment Actual (in 100 million yen)		FY 2021 Grow th Rate(%)	FY 2022 Shipment Estimate (in 100 million yen)		FY 2022 Grow th Rate(%)	FY 2023 Shipment Prediction
Optical Communications Field	5,331		5.3	5,374		0.8	5,935		10.4	flat
Optical Transmission Equipment	1,905		22.3	1,785		▲6.3	2,049		14.8	flat
Truck Line and Metro Line		1,016	39.6		934	▲8.1		1,087	16.4	flat
Subscriber Line		473	9.7		410	▲13.3		518	26.3	little decrease
Router and Switch		193	▲19.9		247	28.0		261	5.7	flat
Optical Fiber Amplifier		223	41.1		194	▲13.0		183	▲5.7	increase
Optical Transmission Components	3,221		▲3.1	3,357		4.2	3,622		7.9	little increase
Optical Transmission Link		324	▲15.0		309	▲4.6		328	6.1	little increase
Light Emitting Device		765	14.2		773	1.0		805	4.1	little decrease
Photo Detectors		154	▲2.5		128	▲16.9		92	▲28.1	flat
Optical Passive Component		235	3.5		220	▲6.4		229	4.1	flat
Optical Circuit Component		253	▲12.5		243	▲4.0		205	▲15.6	flat
Optical Fiber		1,020	▲7.0		1,127	10.5		1,365	21.1	flat
Optical Connector		312	▲2.8		353	13.1		361	2.3	flat
Others（Semiconductor Amplifying Device, etc.）		158	▲12.2		204	29.1		237	16.2	flat
Optical Fiber Fusion Splicer	205		11.4	232		13.2	264		13.8	flat
Optical Storage Field	5,149		▲19.9	4,435		▲13.9	4,978		12.2	flat
Optical Disk	5,088		▲19.8	4,392		▲13.7	4,934		12.3	flat
Equipment		4,797	▲20.6		4,209	▲12.3		4,759	13.1	flat
Read-only (CD, DVD, BD)		2,835	▲25.5		2,561	▲9.7		3,210	25.3	flat
Recordable		1,962	▲12.3		1,648	▲16.0		1,549	▲6.0	little decrease
Media		291	▲4.0		183	▲37.1		175	▲4.4	little decrease
Laser Diode	61		▲26.5	43		▲29.5	44		2.3	flat
Input/Output Field	29,226		▲12.2	31,305		7.1	38,659		23.5	little increase
Optical I/O Equipment	19,806		▲12.0	20,734		4.7	24,642		18.8	flat
Optical Printer・Multifunction Printer		6,173	▲10.8		6,350	2.9		7,605	19.8	little increase
Imaging equipment		7,071	▲17.8		7,731	9.3		10,457	35.3	flat
Digital Camera, Digital Video Camera		5,517	▲17.9		5,873	6.5		8,231	40.1	flat
Security camera, Car-mounted camera *		1,554	▲17.5		1,858	19.6		2,226	19.8	little increase
Camera Mobile Phone		5,717	▲8.6		5,962	4.3		5,913	▲0.8	little decrease
Others (Barcode Reader, Image Scanner, etc.)		845	15.6		691	▲18.2		667	▲3.5	little decrease
Image Sensor	9,420		▲12.6	10,571		12.2	14,017		32.6	little increase
Display and Solid-state Lighting Field	45,940		▲8.7	46,297		0.8	46,006		▲0.6	flat
Display Equipment	23,435		▲8.8	22,355		▲4.6	23,259		4.0	flat
Flat Panel Display		21,367	▲6.5		20,005	▲6.4		20,615	3.0	little decrease
Large-scale LED Display		180	▲8.2		174	▲3.3		178	2.3	little increase
Projector		1,888	▲28.8		2,176	15.3		2,466	13.3	little increase
Display Device	12,968		▲9.3	13,832		6.7	12,661		▲8.5	flat
Solid-state Lighting	6,252		▲8.6	6,404		2.4	6,730		5.1	little increase
LED Device		5,856	▲8.6		6,010	2.6		6,333	5.4	little increase
LED Lamp		396	▲9.4		394	▲0.5		397	0.8	little decrease
LED	3,285		▲6.4	3,706		12.8	3,356		▲9.4	flat
Photovoltaic Energy Field	20,753		▲5.8	17,559		▲15.4	18,235		3.8	flat
Photovoltaic Power System	14,178		▲6.8	11,593		▲18.2	12,178		5.0	flat
Photovoltaic Cell/Module	6,575		▲3.6	5,966		▲9.3	6,057		1.5	flat
Laser/Optical Processing Field	6,144		▲9.2	7,589		23.5	8,351		10.0	little increase
Laser and Optical Processing Equipment	5,425		▲11.9	6,697		23.4	7,328		9.4	little increase
CO_2 Laser		524	74.7		687	31.1		823	19.8	flat
Solid State Laser		428	▲10.1		495	15.7		586	18.4	little increase
Fiber Laser		615	▲23.3		673	9.4		785	16.6	little increase
Semiconductor Laser Direct Processing Equipment		31	0.0		33	6.5		31	▲6.1	flat
Excimer Laser		1,289	▲34.7		1,257	▲2.5		1,748	39.1	little increase
Lamp/LD Exposure Machine		2,479	▲2.8		3,503	41.3		3,295	▲5.9	little increase
Additive Manufacturing (3D Printer)		59	–		49	▲16.9		60	22.4	little increase
Oscillator	719		18.3	892		24.1	1,023		14.7	little increase
Optical Sensing and Measurement Field	2,680		0.2	3,007		12.2	3,270		8.7	little increase
Optical Sensing Equipment	2,528		▲0.3	2,857		13.0	3,108		8.8	little increase
Optical Measuring Instrument	152		9.4	150		▲1.3	162		8.0	flat
Others Field	918		▲6.4	931		1.4	992		6.6	flat

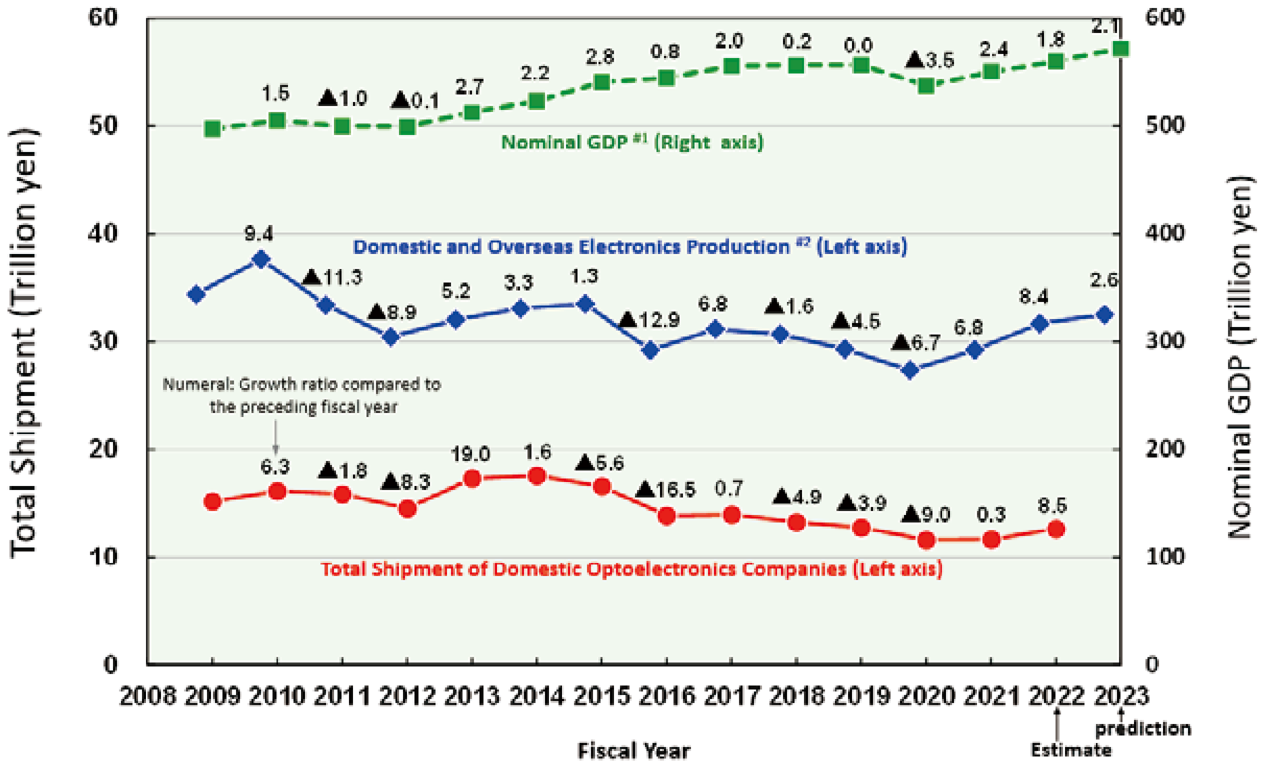
Product Items	FY 2020 Shipment Actual (in 100 million yen)	FY 2020 Grow th Rate(%)	FY 2021 Shipment Actual (in 100 million yen)	FY 2021 Grow th Rate(%)	FY 2022 Shipment Estimate (in 100 million yen)	FY 2022 Grow th Rate(%)	FY 2023 Shipment Prediction
Sub Total for Optoelectronics Equipment	78,974	▲9.4	77,199	▲2.2	84,654	9.7	flat
Sub Total for Optoelectronics Components	37,167	▲8.0	39,298	5.7	41,772	6.3	flat
Total for Optoelectronics Products	116,141	▲9.0	116,497	0.3	126,426	8.5	flat

Table 2 Domestic Production of Optoelectronics Industry

Product Items	FY 2020 Shipment Actual (in 100 million yen)		FY 2020 Growth Rate(%)	FY 2021 Shipment Actual (in 100 million yen)		FY 2021 Growth Rate(%)	FY 2022 Shipment Estimate (in 100 million yen)		FY 2022 Growth Rate(%)	FY 2023 Shipment Prediction
Optical Communications Field	4,132		9.3	4,079		▲1.3	4,557		11.7	flat
Optical Transmission Equipment	1,734		25.4	1,583		▲8.7	1,834		15.9	flat
Truck Line and Metro Line		999	41.1		911	▲8.8		1,075	18.0	flat
Subscriber Line		441	5.3		390	▲11.6		492	26.2	little decrease
Router and Switch		104	▲14.0		116	11.5		111	▲4.3	little increase
Optical Fiber Amplifier		190	40.7		166	▲12.6		156	▲6.0	increase
Optical Transmission Components	2,197		▲1.3	2,274		3.5	2,469		8.6	flat
Optical Transmission Link		160	60.0		163	1.9		171	4.9	little increase
Light Emitting Device		358	9.5		375	4.7		386	2.9	flat
Photo Detectors		58	0.0		49	▲15.5		36	▲26.5	flat
Optical Passive Component		194	▲3.0		178	▲8.2		173	▲2.8	flat
Optical Circuit Component		201	▲15.2		181	▲10.0		139	▲23.2	flat
Optical Fiber		855	▲8.7		947	10.8		1,153	21.8	flat
Optical Connector		200	▲3.8		229	14.5		238	3.9	flat
Others (Semiconductor Amplifying Device, etc.)		171	6.9		152	▲11.1		173	13.8	little increase
Optical Fiber Fusion Splicer	201		16.2	222		10.4	254		14.4	flat
Optical Storage Field	402		▲45.0	226		▲43.8	261		15.5	little increase
Optical Disk	380		▲46.2	203		▲46.6	238		17.2	little increase
Laser Diode	22		▲12.0	23		4.5	23		0.0	flat
Input/Output Field	9,357		▲3.9	9,716		3.8	12,174		25.3	flat
Optical I/O Equipment	4,218		▲5.0	4,076		▲3.4	4,647		14.0	flat
Optical Printer・Multifunction Printer		637	▲18.2		722	13.3		896	24.1	flat
Imaging equipment		2,190	▲2.2		2,105	▲3.9		2,540	20.7	flat
Digital Camera, Digital Video Camera		1,825	▲2.4		1,613	▲11.6		1,916	18.8	flat
Security camera, Car-mounted camera *		365	▲16.1		492	34.8		624	26.8	little increase
Camera Mobile Phone		1,091	1.4		1,006	▲7.8		982	▲2.4	little decrease
Others (Barcode Reader, Image Scanner, etc.)		300	6.8		243	▲19.0		229	▲5.8	flat
Image Sensor	5,139		▲3.1	5,640		9.7	7,527		33.5	little increase
Display and Solid-state Lighting Field	20,824		▲7.4	21,631		3.9	20,767		▲4.0	little increase
Display Equipment	3,340		▲16.8	3,239		▲3.0	3,505		8.2	little increase
Flat Panel Display		3,089	▲15.6		2,961	▲4.1		3,217	8.6	little increase
Large-scale LED Display		180	▲8.2		174	▲3.3		178	2.3	little increase
Projector		71	▲55.6		104	46.5		110	5.8	flat
Display Device	11,145		▲5.7	11,587		4.0	10,385		▲10.4	flat
Solid-state Lighting	4,423		▲4.1	4,571		3.3	4,824		5.5	little increase
LED Device		4,357	▲3.7		4,510	3.5		4,752	5.4	little increase
LED Lamp		66	▲22.4		61	▲7.6		72	18.0	little decrease
LED	1,916		▲6.5	2,234		16.6	2,053		▲8.1	flat
Photovoltaic Energy Field	15,027		▲7.1	12,158		▲19.1	12,653		4.1	flat
Photovoltaic Power System	14,022		▲6.4	11,572		▲17.5	12,164		5.1	flat
Photovoltaic Cell/Module	1,005		▲17.0	586		▲41.7	489		▲16.6	flat
Laser/Optical Processing Field	5,973		▲10.1	7,359		23.2	8,126		10.4	little increase
Laser and Optical Processing Equipment	5,265		▲13.0	6,494		23.3	7,133		9.8	little increase
CO_2 Laser		522	74.6		685	31.2		823	20.1	flat
Solid State Laser		385	▲12.1		439	14.0		546	24.4	little increase
Fiber Laser		501	▲31.9		532	6.2		631	18.6	little increase
Semiconductor Laser Direct Processing Equipment		30	0.0		29	▲3.3		30	3.4	flat
Excimer Laser		1,289	▲34.7		1,257	▲2.5		1,748	39.1	little increase
Lamp/LD Exposure Machine		2,479	▲2.8		3,503	41.3		3,295	▲5.9	little increase
Additive Manufacturing (3D Printer)		59	–		49	▲16.9		60	22.4	little increase
Oscillator	708		19.0	865		22.2	993		14.8	little increase
Optical Sensing and Measurement Field	2,081		▲0.2	2,384		14.6	2,565		7.6	little increase
Optical Sensing Equipment	1,946		▲0.9	2,246		15.4	2,415		7.5	little increase
Optical Measuring Instrument	135		9.8	138		2.2	150		8.7	flat
Others Field	733		▲3.2	867		18.3	956		10.3	flat

Shipment Actual	FY 2020 Shipment Actual (in 100 million yen)	FY 2020 Growth Rate(%)	FY 2021 Shipment Actual (in 100 million yen)	FY 2021 Growth Rate(%)	FY 2022 Shipment Estimate (in 100 million yen)	FY 2022 Growth Rate(%)	FY 2023 Shipment Prediction
Sub Total for Optoelectronics Equipment	35,664	▲7.2	34,344	▲3.7	37,164	8.2	flat
Sub Total for Optoelectronics Components	22,865	▲4.7	24,076	5.3	24,895	3.4	flat
Total for Optoelectronics Products	58,529	▲6.2	58,420	▲0.2	62,059	6.2	flat

fields, both total shipments and domestic production are projected to increase slightly due to capital investment, mainly in the semiconductor and automotive industries. Our forecast for the Optical Communications field indicates that total shipments and domestic production will remain unchanged as investments related to 5G systems and data centers continue. In the Optical Storage field, demand for playback-only equipment for game consoles is expected to continue, with total shipments forecast to remain flat. In Display/Solid-state Lighting, LED lighting equipment is strong, but due to a lack of forward-looking factors in other areas, we forecast that all shipments will be flat while domestic production will increase marginally. In the Photovoltaic Energy field, both total shipments and domestic production are forecast to be flat as the policy to expand installations continues. In the optoelectronics industry as a whole, both total shipments and domestic production are forecast to be flat.



#1 Cabinet Office： National Accounts for 2021／Fiscal 2023 Economic Outlook (Jan. 23, 2023[Cabinet Decision])
#2 JEITA: Production Forecasts for the Global Electronics and Information Technology Industries, Dec., 2022

Fig.1 Total Optoelectronics Shipment, Nominal GDP, and Domestic & Overseas Electronics Production

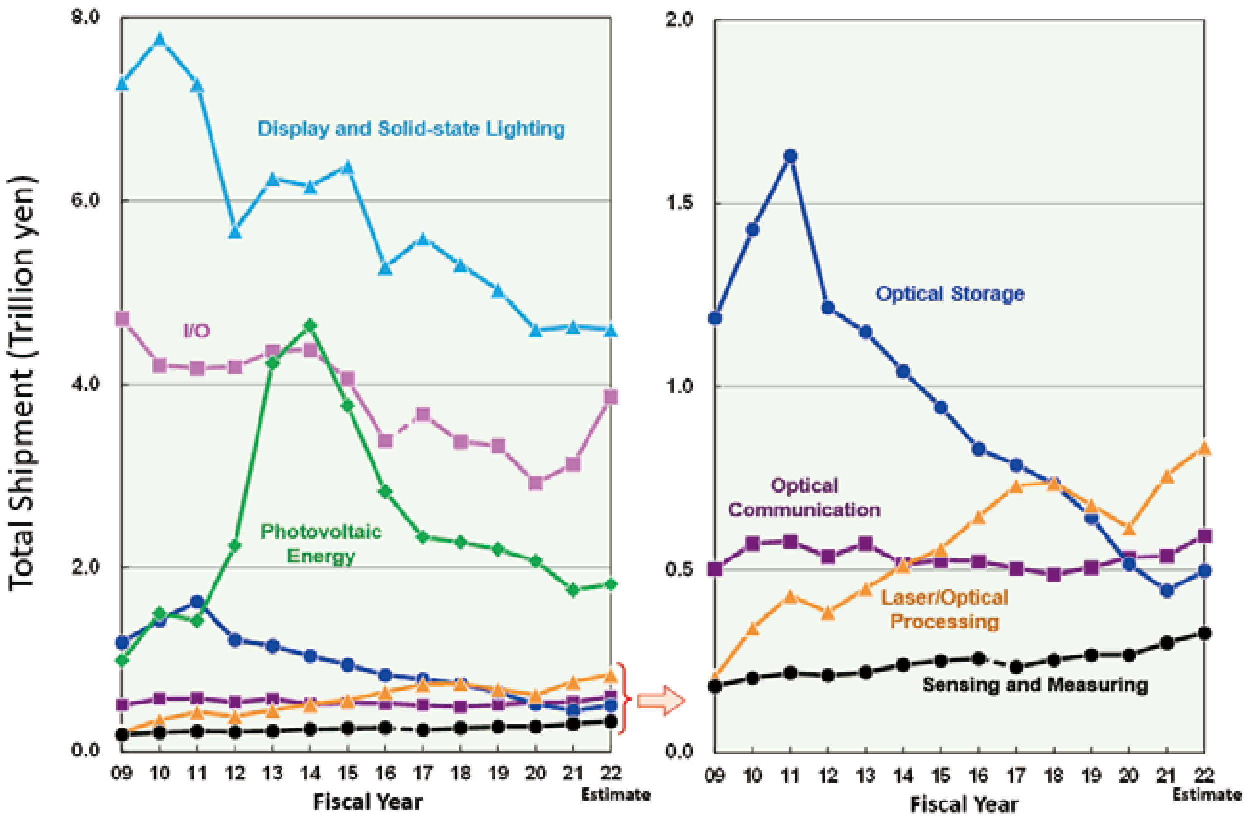
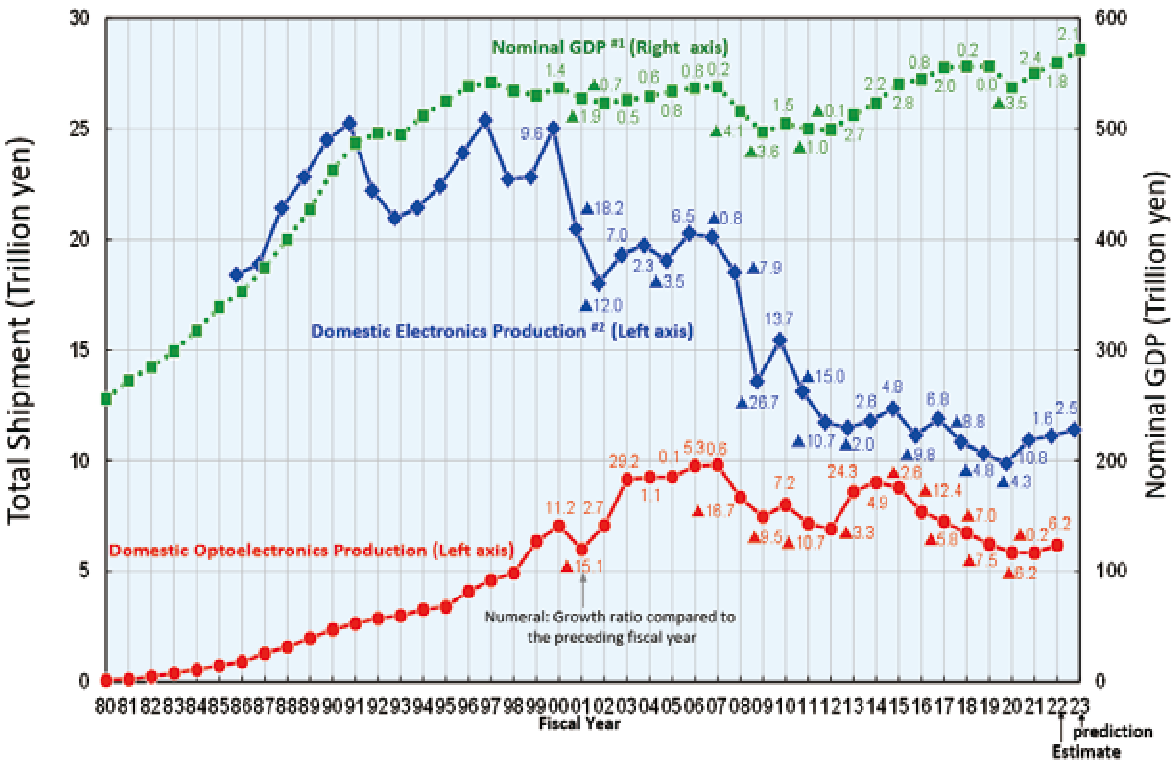


Fig.2 Shipment by Product Field

[Note] The data between FY2016 and FY2017 in the Sensing/Measuring field and the I/O field are shown by the dotted lines because surveillance Cameras and car-mounted cameras have been moved from the Sensing/Measuring field to the I/O field.



#1 Cabinet Office： National Accounts for 2021／Fiscal 2023 Economic Outlook (Jan. 23, 2023[Cabinet Decision])

#2 JEITA: Production Forecasts for the Global Electronics and Information Technology Industries, Dec., 2022

Fig.3 Domestic Optoelectronics Production, Nominal GDP, and Domestic Electronics Production

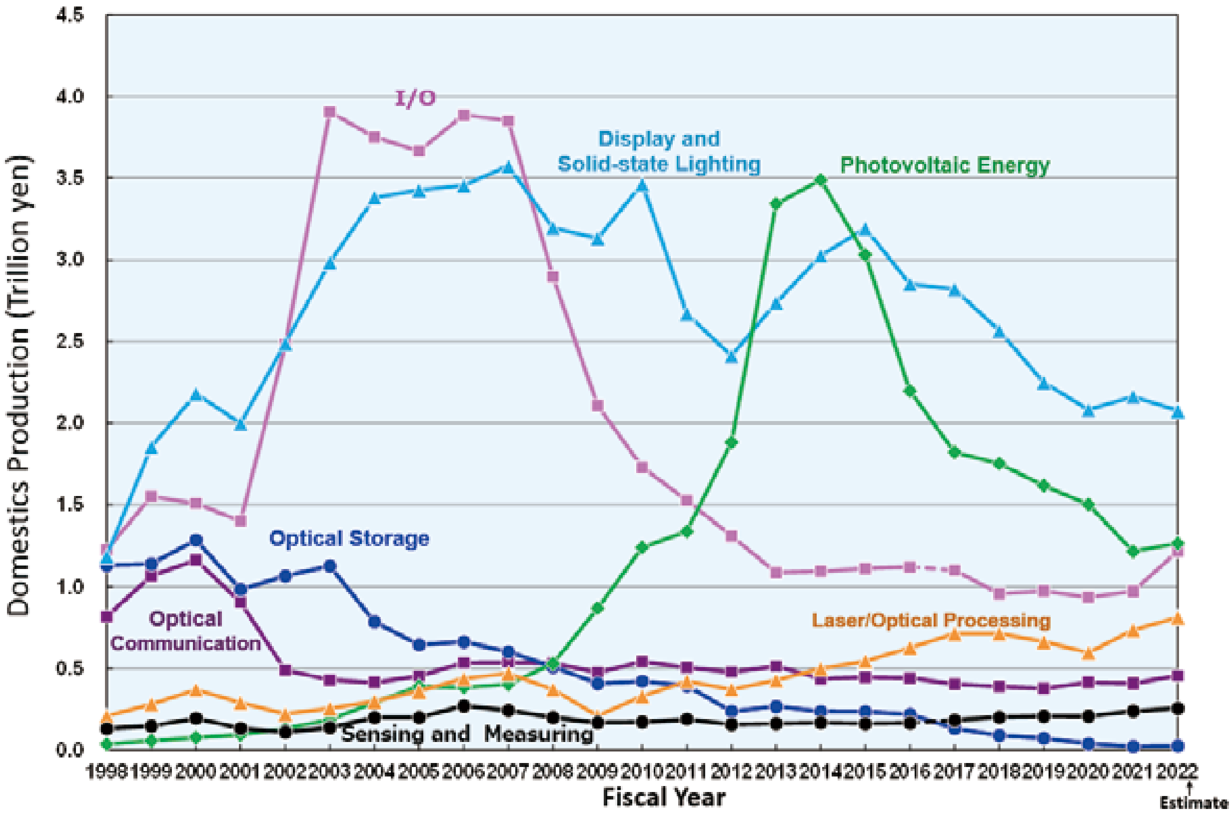


Fig.4 Domestic Optoelectronics Production by Product Field

Technological Strategy Development

1. Introduction

OITDA has been developing Optical Technology Roadmap annually since 1996 with the aim of identifying the future growth of the optoelectronics industry and directing the research and development of optical technologies.

This activity has made sweeping contributions to the development of the optoelectronics industry, laying the groundwork for a multitude of national projects in the fields of data communications, data recording, displays, optical energy, and optical processing. Since FY2016, the goal of strategy formulation has been to determine how optical technology can contribute to specific application fields, rather than by each technological field, and roadmaps had been compiled based on keywords such as automobiles & mobility, AI and IoT, Beyond 5G, imaging, and cyber physical society.

For FY2022, we developed a roadmap for the visible light semiconductor laser technology essential for multiple use cases under the title, Visible Light Semiconductor Laser Technology for Carbon Neutrality. The use cases include adaptation to an ultra-smart society that employs visible light semiconductor lasers, and their agricultural applications.

2. Optical technology roadmap

Recent years have witnessed the research and development of new applications for visible light semiconductor lasers. At the same time, visible light semiconductor lasers are becoming more efficient and powerful, and their oscillation wavelength range is expanding, which will likely lead to the development of promising new applications. The development of applications employing visible semiconductor lasers will probably help resolve social issues we will face in the near future, such as a super-aging society, a declining working population due to a falling birthrate, the advent of a super-information society, and a decline in food self-sufficiency and a decrease in the number of agricultural workers. In addition, the increased use of high-performance visible semiconductor lasers is projected to reduce CO_2 emissions by approximately 63 million tons in 2040 compared to current levels. The FY2022 roadmap identifies future visions for six application fields employing visible semiconductor lasers and outlines a roadmap for the technological fields necessary to realize these visions.

2.1 Application areas

(1) Laser Lighting

Recently, LEDs have surpassed other light sources by a wide margin in terms of efficiency and lifespan, and have become the norm for indoor lighting. Using semiconductor lasers in place of LEDs for illumination affords lighting with unique and superior properties that leverage the high directivity, that is, the extremely high luminance, of the emitted light.

The high luminance of the light emitted by semiconductor lasers also enables multicolor and a wider color gamut. Since the ultimate wide color gamut can be achieved by adding yellow light (Y) to RGB, it is necessary to develop and enhance the efficiency of yellow semiconductor lasers in addition to RGB ones. The integration of Laser Lighting with vital sensing, display, and communications (LiFi) will probably contribute to a society with greater convenience.

(2) Laser Displays

The research and development of Laser Displays began in the 1960s with He-Ne monochromatic laser televisions produced by Texas Instruments. It accelerated in the 21st century due to the remarkable development of laser light sources, including the commercialization of GaN-based pure blue semiconductor lasers. Semiconductor lasers have significant advantages over other light sources in terms of color reproduction, polarization, directivity, small emission area, and high brightness. Thanks to the recent remarkable progress of laser light sources, color Laser Displays, which were once thought to be a dream technology, have become already a reality, and display products such as laser televisions, portable laser projectors, and head-up displays are now in widespread use. In the future, based on the evolution of semiconductor lasers (improved conversion efficiency and single-chip integration), Laser Displays are expected to advance by acquiring further features and functionality such as reduced energy consumption, AR/VR applications, and functional fusion (integrated multi-functionality), while adapting to both super-smart society and carbon neutrality.

(3) Visible Light Communications

Visible Light Communications are characterized by their ultra-low power consumption and scalability, which allow for communications on land, sea, air, and space, where radio waves cannot or are difficult to communicate. LiFi is an indispensable communication method due to its low power consumption and high data transfer rate. By repurposing LED and Laser Lighting implemented in society as communications devices, LiFi can realize an ultra-smart society and reduced power consumption. To utilize semiconductor lasers in these areas, it is crucial to boost the efficiency, responsiveness, and output power of lasers. In addition, the ultraviolet and visible light spectrums require the development of highly sensitive GaN-based PIN diodes.

(4) Laser Assisted Agriculture

Global population growth through 2040 will increase the demand for food. Due to increased global climate change in the natural environment, there is concern that agricultural output will become unstable. For institutional cultivation, which is less susceptible to environmental factors, an alternative light source to sunlight is required. We should acquire multi-wavelength and High Efficiency technologies for visible light lasers by around 2030 and should apply them not only to institutional cultivation but also to open field cultivation, which accounts for the majority of the world's cultivation, by 2040. Although light sources of the whole wavelength must be available to grow plants in the same manner as sunlight, plants can be cultivated by combining multiple wavelengths. Moreover, the use of short-wavelength light can be effective in preventing disease. This is applicable not only to disease control during crop management, but also to the reduction of spoilage-related waste during transport and storage. The advancement of semiconductor lasers can expand Laser Assisted Agriculture in the future.

(5) Optical Wireless Power Transmission

Optical Wireless Power Transmission offers the following features: no wiring is required; devices can be made compact; power can be supplied over long distances; there is no risk of electric shock; and power can be supplied between transparent, light-penetrable objects. These features open up a variety of possible applications, including the powering of household appliances, drones, electric vehicles, robots, and industrial devices and systems, as well as power transmission infrastructure alternative to wires. We envision the possibility of the applications expanding from the powering of robots and other devices in indoor areas where human access is restricted, to that of electric vehicles (EV) and other devices outdoors, as well as infrastructure applications. Accordingly, the supplied power will need to be higher, and the lasers will need to have higher efficiency and greater output power. We envisage the need for higher performance VCSELs, PCSELs, and MQS-LDs as long-distance power transmission requires high beam quality. We envision that after achieving greater responsivity in the violet wavelength range, photodetectors will undergo development for underwater use and higher performance. We also envision that power transmission systems will see the development of essential elemental technologies such as tracking, and achieve longer transmission distances as safety systems become more advanced.

(6) Laser Processing

Due to high electrical and thermal conductivity, copper products will be utilized extensively in EVs, for which future demand is expected to increase. Thus, blue semiconductor lasers have already started to be used practically in copper machining and are being actively used, particularly in manufacturing processes related to batteries, motors, and inverters, which are key components for EVs. Future concerns for high-power blue semiconductor lasers include increasing power, improving beam quality, and decreasing price. As the power conversion efficiency of blue semiconductor lasers increases in the future, the optical output and beam quality of laser processing machines employing multiple blue semiconductor lasers will be greatly improved, and a large number of these machines will be incorporated into the production of EVs and their key components, such as batteries, motors, and inverters. This will probably significantly reduce the cost of EVs with superior safety performance.

2.2 Technical Fields

(1) High Efficiency

Laser devices must have a low threshold, low voltage, and high slope efficiency in order to be highly efficient. Potential solutions to reducing the threshold of GaN-based lasers include thicker active layers (well layers), high-composition AlGaN cladding, thicker AlGaN cladding layers, and high-composition InGaN guide layers. However, all these solutions have parameters that are in a trade-off relationship, so an optimal balance between the parameters must be achieved in design to achieve high efficiency.

(2) Multi-Colorization

Yellow and red, which have longer wavelengths than green, are desirable for laser oscillation. However, the external quantum efficiency of GaN-based lasers is known to decrease significantly at wavelengths of 540 nm or longer, making it difficult to extend the wavelength of GaN-based lasers.

In addition to usual methods for increasing the In and Al compositions, high-quality high-InGaN layers and longer wavelengths are being researched. Such layers can be formed by reducing the stress from the substrate and underlying layers for the high In-composition active layer required for longer wavelengths, and wavelengths can be increased with In concentration, using the properties of cubic GaN.

(3) High Power

Increasing the power of semiconductor lasers presents numerous obstacles that must be overcome. Achieving high efficiency will help in achieving high output power by improving the issue of thermal saturation of the optical output caused by heat generation. To increase the output power of current edge-emitting lasers, it is necessary to reduce self-heating, enhance high heat-dissipation mounts, prevent facet breakdown, and enhance facet coating films. Moreover, surface-emitting lasers, such as VCSELs and PCSELs, can achieve greater output power by expanding the emission area.

(4) Laser Spreading Angle Control

Recently, PCSELs and MQS-LD have been introduced as semiconductor lasers with new structures. Since PCSELs emit laser light perpendicular to the semiconductor substrate, increasing their device surface area can significantly increase output without incurring optical damage. The device presented as a MQS-LD is an edge-emitting device, but by forming the resonator vertically, it can also function as a VCSEL. Therefore, like a PCSEL, it can generate a high-quality beam with a considerably high output, using a single element.

(5) VCSEL,PCSEL,MQS-LD, and Arrays

VCSELs have a reported power conversion efficiency of 13.6% for a single blue laser diode and 3.7% wall plug efficiency (WPE) for a green one. In addition, 256-channel blue VCSEL in a two-dimensional array is reported to have an output of 1.19 W. It is expected that in the future, increased efficiency and multiple channels will lead to higher output.

PCSELs are capable of single-mode oscillation over a large area with a diameter of several hundred μm and are characterized by high output power and narrow divergence angle. Progress is being made in the development of PCSELs of infrared light, with some reported to operate at approximately 7 W, and design guidelines for the 100 W to 1 kW power range have been presented. It has been reported that blue PCSELs have an output of at least 1 W and a divergence angle of approximately 0.2° , and they will probably achieve higher power in the future.

MQS-LD use a nanowire structure. They have an increased active layer volume due to the height of their quantum shell structure and can be arranged to afford a large overlap of in-plane standing waves with the quantum shell active layer. Thereby, they can increase the optical confinement factor, and may enable beam characteristics with high power and high quality through the periodic arrangement of Multi Quantum Shell (MQS).

(6) Tracking

Realistically, tracking information can be acquired in two steps: by recognizing the general direction with a GPS sensor, and then by switching to an optical tracking sensor or a split light receiving device. The optical tracking sensor consists of a wide-angle lens and CMOS sensor, and the split light receiving device controls the azimuth so that the laser is incident equally on each device. In the case of Optical Wireless Power Transmission, adequate performance should be achievable if the transmission method is chosen based on the transmission distance and the speed of the moving object. As for scanners, existing technologies such as Galvanometer scanners, MEMS scanners, and DLP chips can be utilized, and it is possible to track laser beams by making the appropriate selections based on the required accuracy and scanning range.

(7) Interlocking with Sensing

In visible laser applications, Interlocking with Sensing will be essential. Visible laser application systems must incorporate two-dimensional spatial information, distance information, and alignment with laser irradiation optics for application to semiconductor lasers. LiDAR is well-suited for collecting these types of information.

If the development of higher-resolution visible light color LiDAR advances, it will be possible to combine LiDAR, camera, and illumination into a single device, which can be regarded as the ultimate sensor device. In the future, its applications will probably expand into various settings.

By integrating all functionality including illumination, display, spatial optical communications, optical power transmission, and indication, the visible light scanning system will not only have LiDAR functionality, but it will also be applicable to visible light laser systems, such as IoT lighting stations with multiple functions.

3. Summary

GaN-based blue semiconductor lasers still have significant room for development, with the possibility of increasing output by introducing window structures and other designs and decreasing series resistance by introducing tunnel junctions. As such, the early demonstration of those technologies being used to achieve energy efficiencies that surpass that of LEDs will expand realistic expectations for visible light semiconductor lasers. At the same time, we should promote a national project for industry-academia collaboration at an early stage to improve the properties of new semiconductor lasers that have high potential, such as VCSELs, PCSELs, and MQS-LDs, and lead the world in the development of demonstration models for the six application fields.

Standardization

1. Introduction

Standardization has been one of OITDA's major activities since its establishment and has been promoted across the optoelectronics industry. Our standardization efforts are mainly focused on optical transmission, and also include several fiber optics applications and lasers. Our activities cover not just domestic standardization (Japanese Industrial Standards (JIS)), but also international standardization such as IEC and ISO. We also establish and revise OITDA standards and OITDA Technical Papers (TP) to complement obsolete JIS and to serve as literature for international proposals. These standardization efforts are based on ongoing studies by field-specific committees focused on the need for adapting to a changing industrial structure. Outlined below are the activities of each field-specific committee.

2. Fiber Optics Standardization Committee

The Fiber Optics Standardization Committee was established to steer standardization activities for fiber optics. It also serves as the planning and promotion arm of the OITDA Standardization Society General Committee, while coordinating the consistency and overall direction of all standardization activities. It established two acting subcommittees under its wing, the Administrative Advisory Subcommittee and the Intra-Building Optical Wiring Subcommittee.

In FY2022, the committee focused on resolving problems and developing strategies in JIS and international standardization. In addition, it has made great strides in promoting standardization of OITDA standards and TPs, which were studied and introduced by this committee to complement JIS and international standards.

2.1 Administrative Advisory Subcommittee

The Administrative Advisory Subcommittee actively promotes the enactment/revision of OITDA standards and TPs, which are organization standards, in order to propose international standards and to back up JIS standards. It continually identifies and resolves issues to facilitate efficient standardization drafting. Its other duties include the investigation of issues common to each field-specific standardization committee, and coordination with other organizations.

2.2 Intra-Building Optical Wiring Subcommittee

This subcommittee works on the standardization of optical wiring systems for residents or housing providers of houses, apartments, and commercial buildings to enable the use of high-speed, broadband data and video services. Specifically, the subcommittee prepares materials to disseminate and provide information on matters such as FTTH optical wiring in buildings and relevant technological trends.

3. Optical Fiber Standardization Committee

This subcommittee deals with international standards related to optical fiber. Specifically, it ensures harmony between various IEC and ITU-T testing methods and product standards, and reviews JIS according to the enactment and revision of international standards. It also captures the situation in and outside Japan and, as necessary, conducts research and studies to adapt to new technologies so that JIS drafts can be reviewed or revised in a timely manner without incurring opportunity losses.

4. Optical Connector Standardization Committee

Communication networks ranging from backbone, metro, and access networks to data center networks are expected to grow dramatically in scale and capacity. Multiple manufacturers supply a variety of optical fiber connectors (hereinafter, optical connectors) that connect the optical fiber cords and cables in the infrastructure supporting these networks. As a result, it is critical to ensure and guarantee compatibility between manufacturers of the same type of products, which makes standardization efforts extremely important. This committee harmonizes JIS and corresponding IEC international standards for optical connectors in accordance with WTO/TBT agreements that came into effect in 1995.

5. Optical Passive Device Standardization Committee

This committee is responsible for various tasks such as drafting new JIS proposals and revising existing ones pertaining to optical passive components. Additionally, the committee conducts reviews and investigations on general regulations, testing, and measuring methodologies, and individual specifications for optical passive components. The committee also investigates international standardization trends in this field.

6. Optical Active Device Standardization Committee

The general approach of this committee is to develop JIS harmonized with the IEC standards framework.

Currently, the IEC formulates standards for optical active components while envisioning the emergence of new optical transmission systems. These include wavelength division multiplexing passive optical networks (WDM-PON), digital coherent transmission, ultrahigh-speed LAN, and space division multiplexing (SDM) optical transmission. In addition to the standardization of individual components, discussions are also being proposed and deliberated on the standardization of optical active components as integrated functional devices. This standardization includes performance and package standards for analog optical transceivers for mobile front haul and photonic integrated circuits (PICs).

The committee is gathering information about them to engage in its activities.

7. Optical Amplifier and Dynamic Module Standardization Committee

The IEC's decision to merge TC 86/SC 86C/WG 3 and WG 5 promoted the consolidation of the Optical Amplifier Standardization Subcommittee, the Fiber Optics Standardization Subcommittee, and the Dynamic Module Subcommittee into the current Optical Amplifier and Dynamic Module Standardization Committee for Japan's standardization activities. The two main activities of this committee are (1) to prepare translations of JIS drafts while taking into account IEC standardization deliberations and national circumstances, and (2) to keep abreast of international standardization trends and make proposals as appropriate via domestic committees.

8. Optical Subsystem Standardization Committee

IEC/TC 86/SC 86C/WG 1 deals with standardization of the physical layer of optical communication systems and subsystems, establishing design guidelines for optical systems and standardizing test methods for optical systems (systems in general, digital systems, optical cabling equipment and optical links). The committee has been supporting the standardization efforts of SC 86C/WG 1, and has been working on the sequential JIS standardization of IEC standards that have already been issued and for which there is a high need in Japan. In addition, to promote more active proposals to the IEC for technologies in which Japan is making progress, the committee provides assistance in investigating new technologies and preparing documents that contribute to those standardizations.

9. Measuring Instrument Standardization Committee

This committee studies JIS revisions of optical attenuator test methods and optical reflection attenuator test methods for measuring, and optical power meter calibration methods and light source test methods for optical fiber.

10. TC 76/Laser Safety Standardization Committee

In order to strengthen the efforts of IEC/TC 76/WG 5 (Safety of fibre and free space optical communication systems), the Optical Communications Technical Subcommittee was established and carries out activities under TC 76, Laser Safety Standardization Subcommittee. In addition, the committee also collaborates with each of the following groups: JTC 5 (JTC with IEC and CIE) for deliberations on IEC 62471-1; JWG 21 (JWG with IEC TC 34) for deliberations on IEC 62471-7; applicable ISO committees in Japan for JWG 10 and JWG 12 projects to deliberate joint standards with the ISO; and the IEC/TC 86/JAG 10 for matters related to optical fiber communications.

11. ISO/TC 172/SC 9 Standardization Committee

In FY2022, regarding the deliberation of ISO documents, this committee deliberated the documents circulated by each WG of the ISO and proposed opinions from Japan. With regard to efforts for the ISO/TC 172/SC 9 international meeting, the committee sent experts to the annual meeting of SC 9 (held remotely) to reflect Japanese opinions on international standard proposals.

12. Optical Disk Standardization Committee

The Optical Disk Standardization Committee is a standardization group specializing in the standardization of optical disk-related technologies. Its main activities include the drafting of domestic standards, and research and study of related technology trends. It established two subcommittees that conduct activities under its wing, the Media Technical Subcommittee and Format Technical Subcommittee.

12.1 Optical Disk Media Sub-committee

This technical subcommittee conducts research and study activities related to standardization of physical format standards, application standards, and reliability evaluation standards for magneto-optical, phase-change, write-once, and read-only optical disks.

12.2 Optical Disk Format Sub-committee

This technical subcommittee conducts research and study related to volume and file formats for optical disks.

13. Fiber Optic Sensors Standardization Committee

This subcommittee was established as a technical subcommittee under the former Fiber Optics Standardization Committee with the purpose of acting as a domestic committee (mirror committee) of IEC/TC 86/SC 86C/WG 2. It reflects Japanese opinions in the preparation of international standards and actively disseminates Japanese technologies as international standards. The committee took its first step toward its aspirations of creating JIS drafts by officially drafting JIS C 617575 (corresponding international standard IEC 617575) in January 2022. In April of the same year, it transitioned from a Technical Subcommittee to a Standardization Committee. In February 2023, this JIS was published in the Official Gazette.

14. International Standard Development Committee for In-vehicle Ethernet System Integrity

In-vehicle communications are expected to increase in capacity to allow for advanced driving assistance systems and automated driving. In-vehicle Ethernet standards with enhanced real-time performance and fail-safe features require high reliability to serve as the communication backbone and sensor network for connecting core units in autonomous vehicles. Particularly with regard to EMC, a reliable in-vehicle communication system can be achieved by combining a communication board with excellent EMC characteristics and an optical harness that neither generates nor is affected by electromagnetic noise. The fourth phase of this project (three years) was launched in FY2020, and FY2022 was the third year of this project. In addition to development of IEC, ISO and IEEE standards, the project will advance the development of evaluation methods for in-vehicle communication systems aiming at system integrity and preparations for the establishment of testing and certification bodies. Continuing from last year, the project developed a total of 12 standards: 9 new, 2 continued/revised, and 1 revised. These were mainly related to Multi-gigabit Ethernet.

15. Optical Disk Archiving Grade Standardization Committee

Due to the rapid progress of the information explosion in recent years, optical disks are expected to drive the creation of an archive market as a strategic storage medium for digital data. Against this backdrop, this project has developed evaluation criteria for optical disk archive systems based on physical standards and lifetime estimation standards for each optical disk product (CD, DVD, BD, etc.) that have been established so far. The evaluation criteria include a media grading system based on the initial performance of the optical disk itself, and consistency with drives to ensure the recording quality of digital data. Currently, in order to expand the data storage infrastructure on a global scale, and strengthen the international competitiveness of optical disk archiving systems and media, the committee is (1) revising JIS to incorporate new issues identified through operation, and (2) expanding those standards to international standards.

16. International Standardization Proposal Committee on Optical Interoperability of Connectors for Multicore Fibers

In order to meet the ever-growing demand for communications, the practical application of Space Division Multiplexing (SDM) technology aiming at increasing transmission capacity has become an urgent issue. A system using Multi-Core Fiber (MCF) has been developed as a method to realize SDM technology, and an optical connector for MCF is indispensable to realize this system. On the other hand, when used in an optical network, standardization regarding optical interoperability, which is necessary for performance assurance when optical connectors of a plurality of manufacturers are connected to each other, is required. Therefore, we aim to expand the market worldwide in the future through the rapid spread of new technologies for optical connectors for MCF, which has been developed in Japan. This project is a three-year project from 2021. At the IEC meeting, the technical presentation had been made for the international standardization of optical connectors for MCF, and a draft international standard for optical interoperability of optical connectors for MCF will be prepared. We propose it to IEC / TC 86 / SC 86B and work toward the target of registering it as an international standard NP (New Work Item Proposal) by February 2024.

Educational and Public Relations Activities

1. FY 2022 Symposium on Optoelectronics Industry and Technology

The FY 2022 Symposium on Optoelectronics Industry and Technology was held at the Rihga Royal Hotel Tokyo on Wednesday, February 8, 2023. The event was jointly sponsored by OITDA and the Photonics Electronics Technology Research Association (PETRA), with support from the Ministry of Economy, Trade and Industry. Under the theme of "Carbon neutral future pioneered by optoelectronics technology, six important presentations were given as shown in Table 4. with around 170 participants.

2. interOpto

interOpto2022, an international exhibition of cutting-edge optoelectronics technology, was held at Tokyo Big Sight for three days from June 15th to June 17th, 2022, with support and cooperation from the Ministry of Economy, Trade and Industry and many other organizations.

interOpto2022 was under the theme of "Optical/Next Generation Application Network System Exhibition" in the total solution exhibition for electronic devices held mainly at the "JPCA Show."

The Concurrent Exhibition had 12 exhibitions including optical-related "LED JAPAN" and "Imaging Japan", "JPCA Show" that was a general exhibition for electronics equipment, devices, and mounting equipment, "Smart Sensing" and "Edge Computing." At Tokyo Big Sight, the entire Concurrent Exhibition took place across East Halls 4 to 6. The total number of visitors to the whole exhibition, which consists of 12 exhibitions, over the three days was 27,972, a significant increase from the previous years' 16,699.

In the exhibition hall, setting up the annual "Notable Optoelectronics Technology/Special Exhibit Zone", two organizations recommended by the subcommittee of OITDA's Optoelectronic Technology Trend Research Committee exhibited their technologies and products.

At the OITDA booth, we conducted public relations activities such as providing the latest information and exhibiting panels, research reports of optical industry and technology, and distributing Annual Technical Report for free.

In addition, on June 15 (Wednesday), the 2022 OITDA seminar was held under the theme of "Optical technology for the realization of a cyber-physical society."

A total of 122 people participated in four presentations on the latest optical technology and its applications and services for realizing a super smart society in which cyberspace and the real physical society are highly integrated.

3. 38th Kenjiro Sakurai Memorial Prize

The Kenjiro Sakurai Memorial Prize was established in 1985 to acknowledge the achievements of the late Kenjiro Sakurai, former director of OITDA, and to promote the advancement of the optoelectronic industry and technology. It is awarded to individuals and groups for their pioneering work in the field of optoelectronic industrial technology.

At the ceremony for the 38th Kenjiro Sakurai Memorial Prize held in FY2022, the award was presented to the sole recipient described

Table 4　FY 2022 Symposium on Optoelectronics Industry and Technology

10:00 ～ 10:05	Opening Remarks	Mr. Yasuhisa Odani President / Vice Chairman, OITDA
10:05 ～ 10:15	Guest Greeting	Mr. Hisashi Kanasashi Director, IT Industry Division, Commerce and Information Policy Bureau, METI
10:15 ～ 11:15	Keynote Speech: Carbon-Free Energy Goal and Use of Optical Circuit Switch at Google Datacenters	Mr. Etsuji Nakai Cloud Solutions Architect Google Cloud Mr. Sotaro Horichi DCT & Digital sovereignty Solution Lead Solution & Technology Google Cloud Japan G.K.
11:15 ～ 12:00	Laser-Clad Valve Seat to reduce CO_2 emissions	Mr.Tadashi Oshima Senior Researcher Energy Efficient Material Processing Research-Domain TOYOTA CENTRAL R&D LABS., INC
13:00 ～ 14:00	Visible semiconductor laser technologies for carbon neutral	Dr.　Satoshi Kamiyama Professor, Faculty of Science and Technology, Department of Materials Science and Engineering Meijo University
14:00 ～ 14:45	Optical Wireless Power Transmission Technology - Potential for Indoor Equipment, Dynamic Charging to Mobilities, and Underwater Applications -	Dr. Tomoyuki Miyamoto Associate Professor Photonics Integration System Research Center ,FIRST Tokyo Institute of Technology
15:00 ～ 15:45	Photonic electric hybrid switch system for high-speed and low-power data transmission	Dr. Kenya Suzuki Photonics Electronics Technology Research Association (PETRA)
15:45 ～ 16:30	Photonic Devices using Heterogeneous Material Integration towards High Efficient and High Speed Processing Distributed Computing	Dr. Hideki Yagi Photonics Electronics Technology Research Association (PETRA)
16:35 ～ 17:00	38th Kenjiro Sakurai Memorial Prize	

below.

The Prize ceremony was held after the 2022 Symposium on the Optoelectronics Industry and Technology on February 8, 2023, at the Rihga Royal Hotel Tokyo.

At the award ceremony, Dr. Yasuhiko Arakawa (The University of Tokyo), Chair of the Kenjiro Sakurai Memorial Prize Committee, reported on the selection process and results. This was followed by the presentation of a certificate, medal, and commemorative souvenir to the recipient.

Prize winning title

"Development of high-efficiency organic light-emitting materials and their application to optoelectronic devices"

Reason for Prize

Dr. Chihaya Adachi has been devoted to the research and development of organic light-emitting diodes (OLEDs) for more than 30 years. He proposed a double heterostructure with a creation of an electron transport material, demonstrating the perfect confinement of charge carriers and molecular excitons within an ultra-thin emitting layer. This result has been widely used in present OLEDs as a standard device architecture. As a noteworthy achievement, he invented a rare metal-free thermally activated delayed fluorescence material, realizing an internal quantum efficiency of 100% in OLEDs. In addition, he enthusiastically worked on the development of OLEDs with increased color purity and a wider color gamut and the challenge of organic semiconductor lasers. In this way, Dr. Adachi has created highly efficient organic light-emitting materials based on his deep knowledge and insight into the molecular design of organic materials. He has contributed to the development of Japan's optoelectronics industry, especially the display field.

Supporting Members

(As of March 31, 2023)

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Japan Optomechatronics Association

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TOYOTA Central Research and Development Labs., Inc.

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Yazaki Corporation

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