

GLASS FOR FUTURE



CORPORATE PROFILE

GLASS FOR FUTURE

CLASS

Special Glass can be formed into a variety of shapes and infused with different properties and functions. It can be made into unique materials and products for use in diverse fields such as IT equipment, automobiles, medical care, lighting, architecture, and the energy sector.

Special glass increases the speed and capacity of data communication. It makes automobiles lighter and stronger and improves fuel efficiency. It doesn't break at high temperatures and protects against fire. It reinforces concrete and provides a solution to aging infrastructure.

GLASS FOR FUTURE

By combining our accumulated technical know-how with unique solutions, we continue to deliver innovative glass products for use in industry and daily life to contribute to society and to create a brighter future.

FOR FUTURE



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The Nippon Electric Glass Corporate Philosophy Structure

Established on December 1, 2015

At Nippon Electric Glass, our corporate philosophy is a reflection of our founding mission, a statement of our devotion to creating products infused with the very best of human civilization for the betterment of society.

[Our corporate philosophy]

We strive to build a brighter future for the world by uncovering the unlimited possibilities of glass for more advanced creative manufacturing.

Firmly rooted in the traditions of our founding mission, the NEG corporate philosophy plots a path for our quest for sustainable growth. Thanks to material design, melting, forming, and processing technologies, glass can be infused with different properties for a broad range of functions. We are dedicated to unlocking glass's potential to make life better and more comfortable for people and communities the world over.

Our slogan

GLASS FOR FUTURE

[Our vision]

The world's leading manufacturer of special glass

Our goal is to become the world's leading manufacturer of special glass, with the best talent, the best technology, and the best creative manufacturing ability. At the same time, we strive to run our company in a way that inspires pride among our workers and enables us to make a genuine contribution to the community. The way we see it, creative manufacturing is achieved through state-of-the-art technological development, the highest quality standards, efficient production, and a steady supply of products, all underpinned by a fundamental dedication to environmental sustainability.

[Our values]

- Customer first Everything is based on accurate understanding and complete satisfaction of customers' requirements.
- Get the job done We are dedicated to completing every task properly.
- Broad minds and open communication We think beyond existing norms and encourage frank communication among all departments and generations.
- High ethical standards We are bound to act ethically and in good faith in all situations.
- Consideration for the environment We are constantly aware of the need to be considerate of the environment, and strive to reduce our footprint.



Striving to Build a Brighter Future through Glass Manufacturing

We have been developing and providing glass suitable for the times since the company was established in 1949. Beginning with glass tubing for vacuum bulbs in radios, we have expanded our product line to various areas that support society, including automotive and transportation, ICT and semiconductors, medical care, displays, lighting, energy, social infrastructure, and home appliances.

In recent years, the needs for glass have changed substantially to adapt to rapid transitions in society and the market environment. Through state-of-the-art glass manufacturing technology, we are able to produce glass products with various shapes and diverse functions. Our glass products help address social needs such as reduction of environmental burden, innovation of ICT, and the advancement of medical care. In this way, we will continue to grow sustainably and help to realize a richer, safer, and more comfortable society.

M. MATSUMOTO

Motoharu Matsumoto
President
Nippon Electric Glass Co., Ltd.



Automotive and Transportation



ICT and Semiconductors



Medical Care

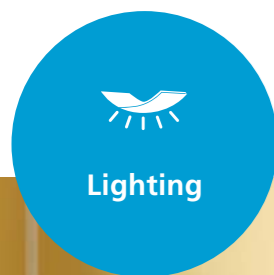


Displays

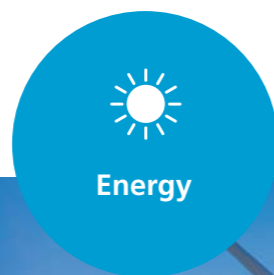
GLASS IN OUR LIFE

Product areas

The special glass we produce plays unnoticed roles in various areas, such as thin, smooth glass substrates in television displays, glass fiber in high-function plastic automobile parts, and glass for electronic devices such as smartphones. In addition, our glass-ceramics are used in top plates of cooking appliances and walls in train stations. At home, in the office, and in the city, wherever they are found, our glass products contribute to making life more comfortable.



Lighting



Energy



Social Infrastructure



Home Appliances



Mobility through Innovative Technology



From automobiles to railways and aviation

To accommodate stricter environmental regulations, improvement of fuel efficiency and environmental performance are urgent issues in the field of transportation. Glass fiber with a diameter just over 10 μ m has great mechanical strength and improves the strength, hardness, and dimensional stability of plastic and is used worldwide to reduce the weight of automobile parts and components.

Our glass is also used for in-vehicle displays and sensor-related products. Lamion™ is gaining popularity for use in train station platform doors.

Products



FRTP (fiber reinforced thermoplastic) as an alternative for metal engine parts

E-Glass Fiber

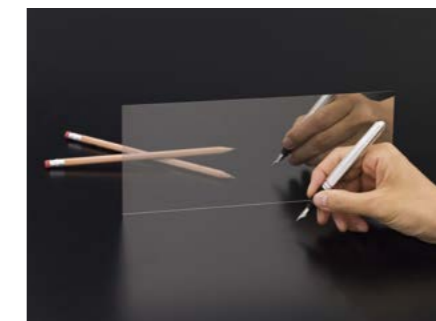
Plastic reinforced with our glass fiber is used in automobile parts such as engine components to contribute to weight reduction and better fuel efficiency. Since the use of resin allows for integrated molding of complicated parts, it helps to conserve energy in the manufacturing process.

Display-related Glass

Display glass is used in smart rearview mirrors and information displays for vehicles. The half mirrors used in rearview mirrors function as normal mirrors and can be switched to display images from a rear-view camera. Even during bad weather or at night, clear rear-view images can be displayed.



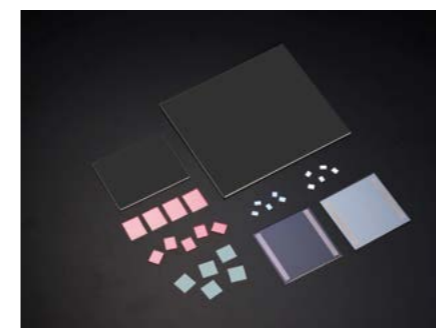
E-Glass Fiber products



Half mirror, display-related glass

Sensor-related Glass

In-vehicle sensors are an essential part of safe and comfortable driving. Our cover glass for image sensors, infrared absorbing filters, and band pass filters are important parts of in-vehicle sensors.



Sensor-related glass



Lamion™, used in station platform doors

Lamion™, Ultra-thin Glass Laminated on Resin

G-Leaf™ (see page 13) is laminated onto one or both sides of a resin plate or film to make Lamion™. This hybrid material has both the abrasion resistance and gas barrier properties of glass and the lightweight and shock resistance of resin. It is being used in train station platform doors and covers for digital signage.

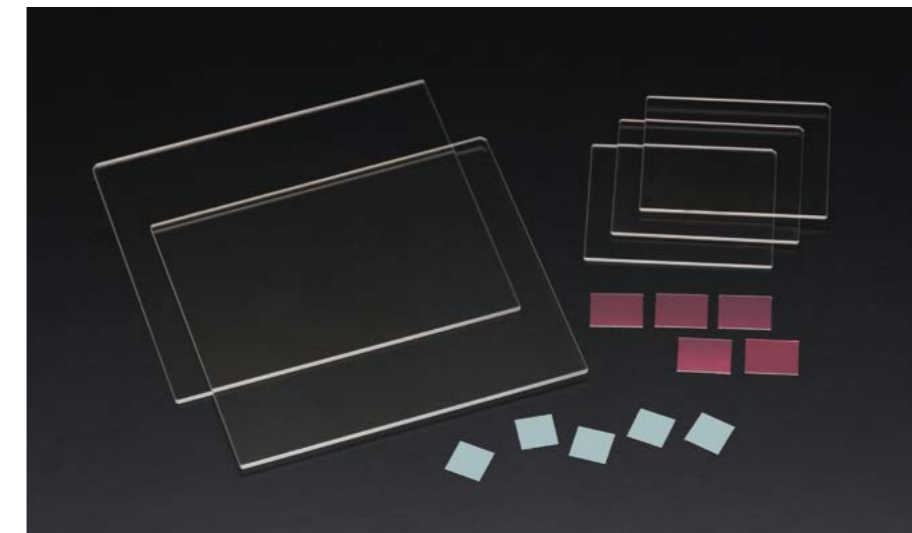
Advancement of an Information-oriented Society



To become a keystone for information communication

The information communication field is constantly undergoing rapid market changes and technological innovation. Glass with excellent properties, such as transmittance, hermeticity, and electrical insulation, plays an important role in optical and electronic devices that support a highly information-oriented society.

Products



Glass Substrate/Cover Glass

We offer a variety of glass substrate products which have optical and/or electrical functions, mechanical strength, and chemical durability. Applications include cover glass for image sensors and infrared absorbing filters used in sophisticated cameras, and glass for supporting semiconductor wafers used in the semiconductor manufacturing process.

Cover glass for image sensors and infrared absorbing filters



Processed powder glass products



Ceramic packages sealed using glass frits

Functional Powder Glass/ Glass Paste

These are widely used to form insulating films, coat electronic components, and hermetically seal electronic devices such as power semiconductors. Material design can be optimized for each application. Processed products also include green sheets, glass paste, and tablets.

Glass for Optical Communication

By utilizing material development, precision machining, and assembly technologies required for glass manufacturing, we provide various products that connect high-speed optical communication networks. Products include micro prisms, micro lens arrays, micro balls, aspherical lenses, and micro capillaries.

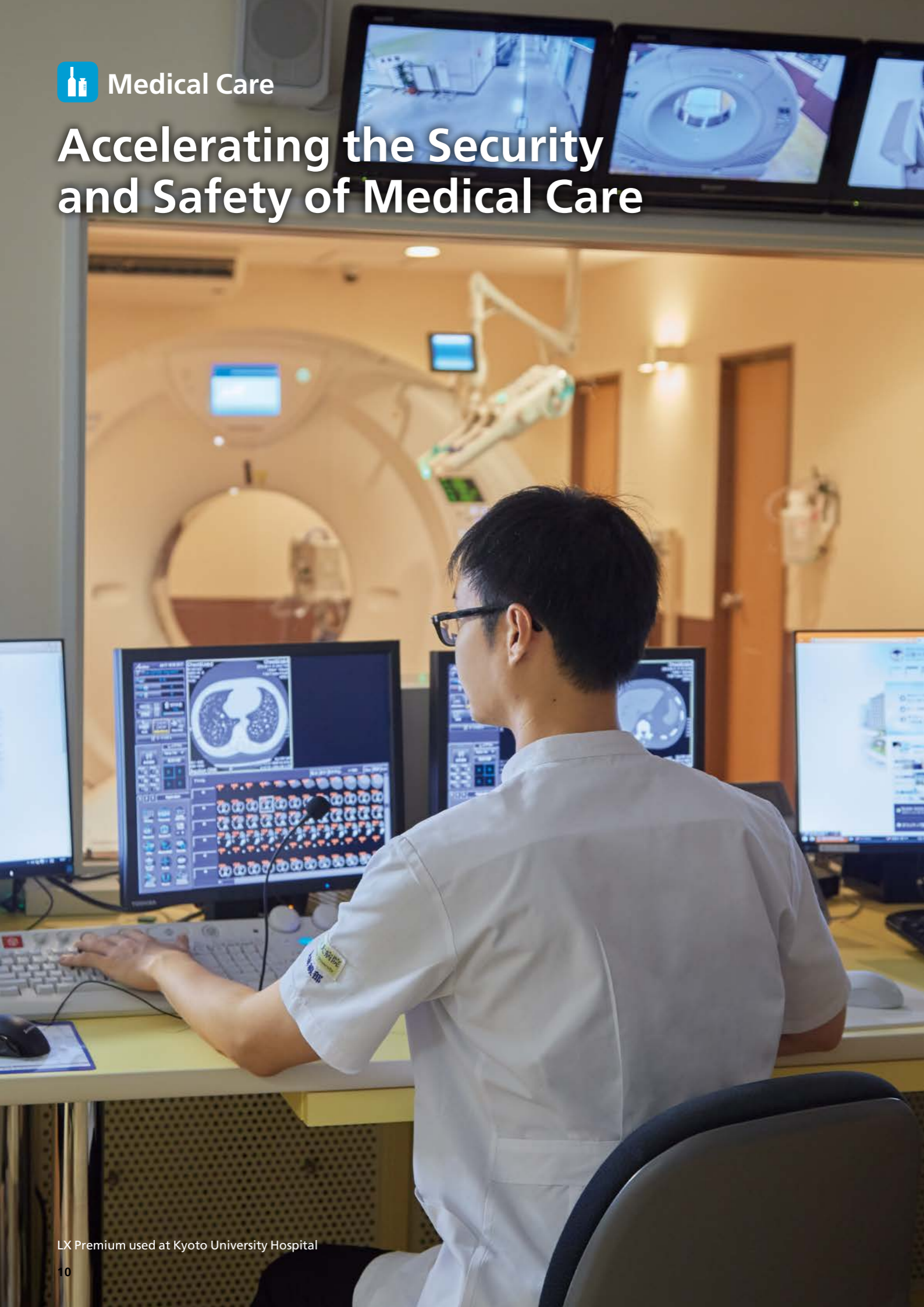


Module components for optical communication

Glass Frit for Laser-sealing of Ceramic Package

We developed the world's first glass frits for laser-sealing of ceramic packages that are an optimal solution to sealing glass lids and ceramic cavities. Our glass frit for laser-sealing of ceramic package enables local laser heating, which reduces thermal damage and contributes to increased reliability and extended lifetime of electronic devices.

Accelerating the Security and Safety of Medical Care



LX Premium used at Kyoto University Hospital

Supporting the advancement of medical care

We have been contributing to the development and improvement of safety in the medical field by supplying glass tubing for pharmaceutical and medical use as well as radiation shielding glass. Glass tubing is used for ampoules, vials, and injection syringes. Radiation shielding glass protects health care providers from radiation exposure.

Products



Glass tubing for pharmaceutical and medical use

Glass Tubing for Pharmaceutical and Medical Use

BS (Clear Borosilicate Glass Tubing) has excellent chemical durability and heat and shock resistance. It is an advanced glass with a low coefficient of thermal expansion and low alkaline elution. We also produce BS-A (Amber Borosilicate Glass Tubing) that has both a light-shielding effect and visibility features.

Radiation Shielding Glass

This high-performance glass protects health care providers from radiation exposure. Its high transparency contributes to accurate diagnosis. LX Premium can be wiped with a wet cloth and has excellent shock resistance. GR Premium is a gamma-ray shielding glass suitable for positron emission tomography (PET) facilities.



LX Premium used at Keio University Hospital

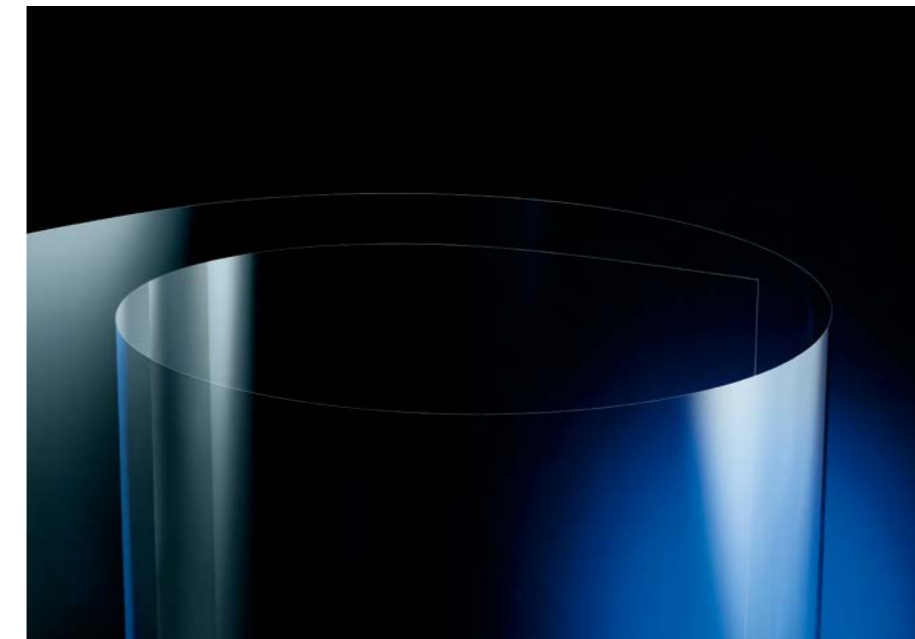
Adding New Value to Evolving Imaging Technology



Enriching communication

Displays are essential as an interface for communication devices such as televisions, computers, digital cameras, and smartphones. With our highly-advanced technology, Nippon Electric Glass supports the continuing evolution of larger, higher-precision, and flexible displays.

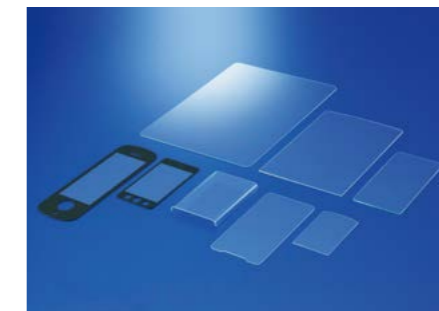
Products



G-Leaf™, ultra-thin glass



OA-11, glass for flat panel displays



Dinorex™, glass for chemical strengthening

Glass for Flat Panel Displays (FPDs)

Alkali-free glass substrates (OA-10G and OA-11) are used for flat panel displays such as LCDs and OLED displays, since they do not affect semiconductors in the display manufacturing process. Our glass substrate, with extremely smooth surface, is formed by the overflow process. OA-11 is easy to handle even though the glass substrate is very thin, with little deformation and gravity deflection.

G-Leaf™, Ultra-thin Glass

G-Leaf™ is an ultra-thin glass no more than 0.2 mm (200µm) thick that maintains the excellent functions and reliability of glass. Since it can be rolled up, it improves transport efficiency and enables roll-to-roll processing, and is regarded as a next-generation material. It contributes to energy conservation and reducing environmental burdens. G-Leaf™ is ideal for use in many areas, including displays.

Dinorex™, Glass for Chemical Strengthening

Dinorex™ was developed as glass for chemical strengthening for use in cover glass to protect screens for smartphones and tablets. It is also being used as covers for CID (center information displays) and instrumental panels for automobiles.

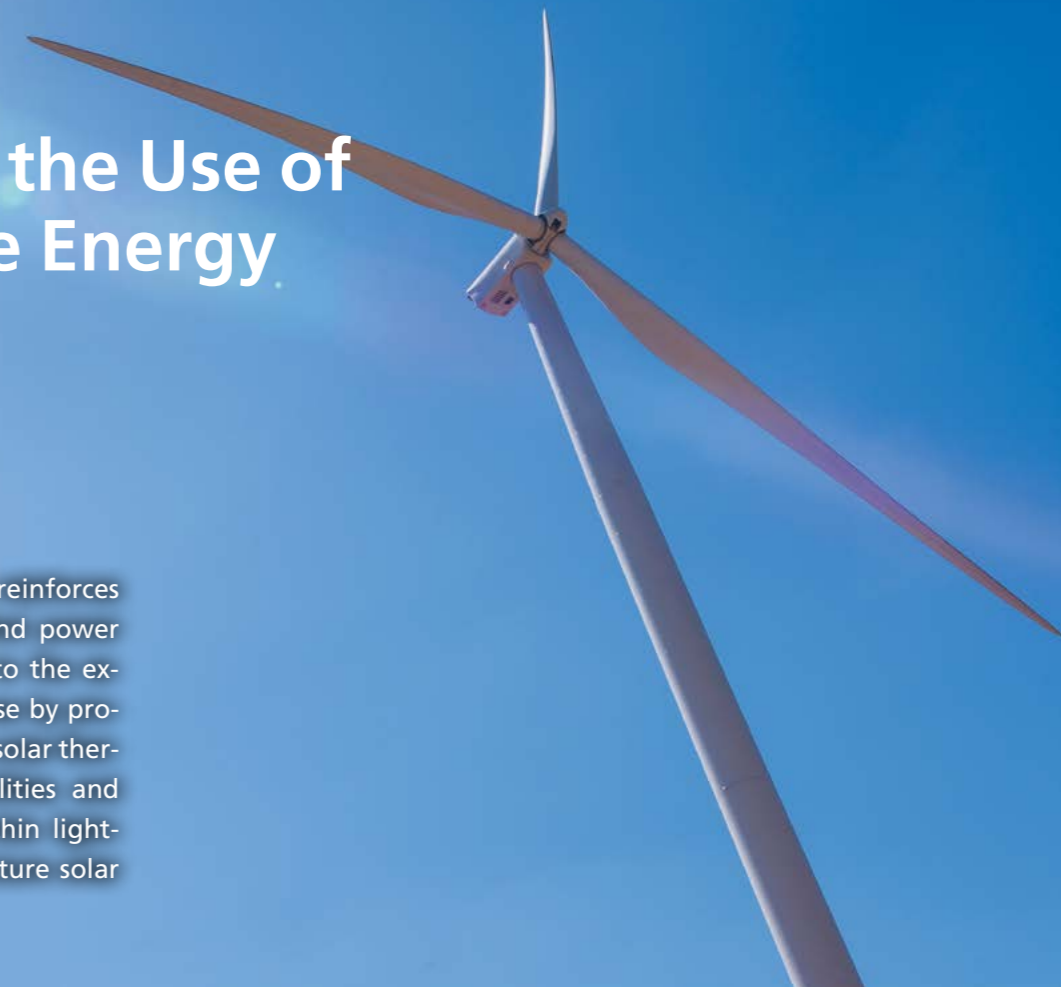
Expanding the Possibilities of Next Generation Lighting

Our glass is used in lighting with high luminance and high output such as LED lighting, LD (laser diode) lighting, OLED lighting and other lighting applications. Our glass contributes to the improvement of luminance and energy conservation.

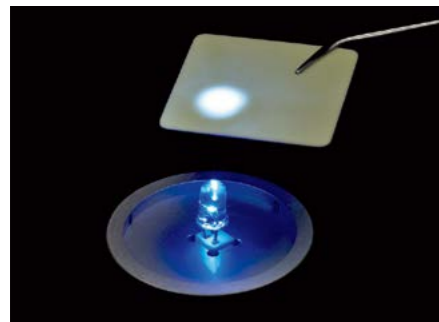


Increasing the Use of Renewable Energy

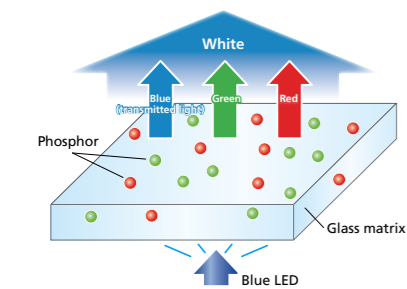
We supply glass fiber that reinforces wind turbine blades for wind power generation. We contribute to the expansion of natural energy use by providing solar mirrors used for solar thermal power generation facilities and endeavor to develop ultra-thin lightweight mirrors for use in future solar power generation in space.



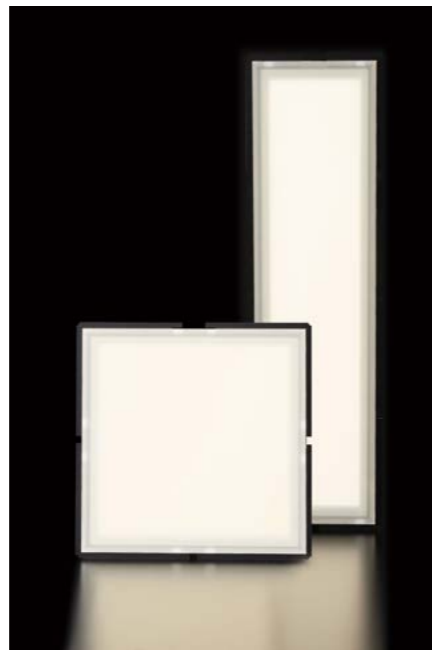
Products



Lumiphous™, phosphor-glass composite



Conceptual diagram of Lumiphous™



OLED lighting using glass substrate with IEL

Lumiphous™, Phosphor-Glass Composite

Lumiphous™ is a phosphor-glass composite that changes the wavelengths of a light source of LED and LD lighting. With less dispersion, it can express a variety of colors. Compared to resin materials, it has excellent heat, light, and water resistance, and high-power light emission.

Glass Substrate with Internal Extraction Layer (IEL) for OLED lighting

This glass can efficiently bring out light that occurs in OLED layers and substantially improves the luminance of OLED lighting.

Products



E-Glass Fiber roving



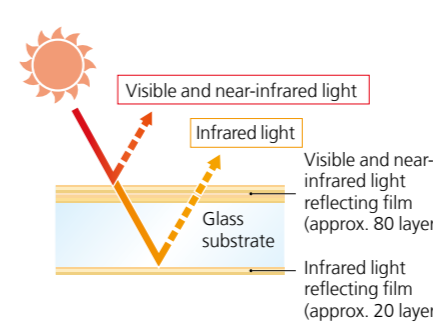
Wind turbine blades using E-Glass Fiber

E-Glass Fiber

Wind power generation uses wind to generate electricity. Wind turbine blades made of glass fiber reinforced plastic (GFRP) using our E-Glass Fiber are lightweight and have weather resistance that can withstand strong wind, salt damage, UV light, and other factors.



Solar mirrors



Structure of solar mirrors

Solar Mirrors

Almost 100% reflectance is realized by forming 100 dielectric layers on glass substrate with high light transmittance and heat resistance and a low coefficient of thermal expansion. The coatings are resistant to 300°C or more and the solar mirrors are used in photovoltaic power generation. We combined this with ultra-thin glass technology to develop mirrors for use in outer space for the Space Solar Power System (SSPS).

Improving Safety and Comfort



We provide innovative products such as fire-rated glass which helps protect life and property, glass blocks and glass-ceramic building materials which provide outstanding performance in terms of design and function, and ultra low reflection glass for use in store showcases.

E-Glass Fiber used in resin railway ties at JR Shin-Osaka Station

Glass Products for Daily Life



Heat-resistant glass exhibits outstanding resistance to rapid heat changes. Due to its high functionality, it is used in top plates of cooking appliances, microwave turntables, and fireplace windows.

Products



FireLite Plus™ used in the exterior of Shinjuku Expressway Bus Terminal



Application of Invisible Glass™; Miyamoto Shoko's main store in Ginza (Tokyo)



ARG Fiber used in Chhatrapati Shivaji International Airport (Mumbai, India)

FireLite™, Fire-Rated Glass

With an extremely low coefficient of thermal expansion, FireLite™ can withstand rapid temperature changes and does not break during a fire even when hosed with water. FireLite™ meets U.S.A. UL* standards. FireLite Plus™ is made of layers of FireLite™ laminated together and will not shatter even when it breaks. This is the only laminated glass approved for use in fire protective facilities in Japan. *Underwriters Laboratories

Invisible Glass™, Ultra-low Reflection Glass

Bare glass has a luminous reflectance of approximately 4% per side, however, the reflectance of Invisible Glass™ is around 0.08% to 0.5% per side. It minimizes light reflectance, making it ideal for use in showcases and protective picture frame covers.

ARG Fiber

With its exceptional alkali and acid resistance, ARG Fiber is widely used in construction and civil engineering areas as a reinforcing material in GRC (glass fiber reinforced concrete) and to prevent cracks in mortar and concrete. Its reinforcement effect provides the strength for complicated designs without the need to use reinforcing steel and improves installation efficiency through modularization of parts and increases the possibilities of architecture.

E-Glass Fiber

Rigid urethane resin is reinforced with E-Glass Fiber to produce plastic foam material which can be finished to create a wood texture. With excellent strength, lightness, corrosion resistance, and ease of forming, this material is used to simulate wood in railway ties and other applications.

Products



Neoceram used in fireplace windows



Neoceram formed by pressing process



Neoceram formed into tubes



StellaShine™

Neoceram, Super Heat-Resistant Glass-Ceramics

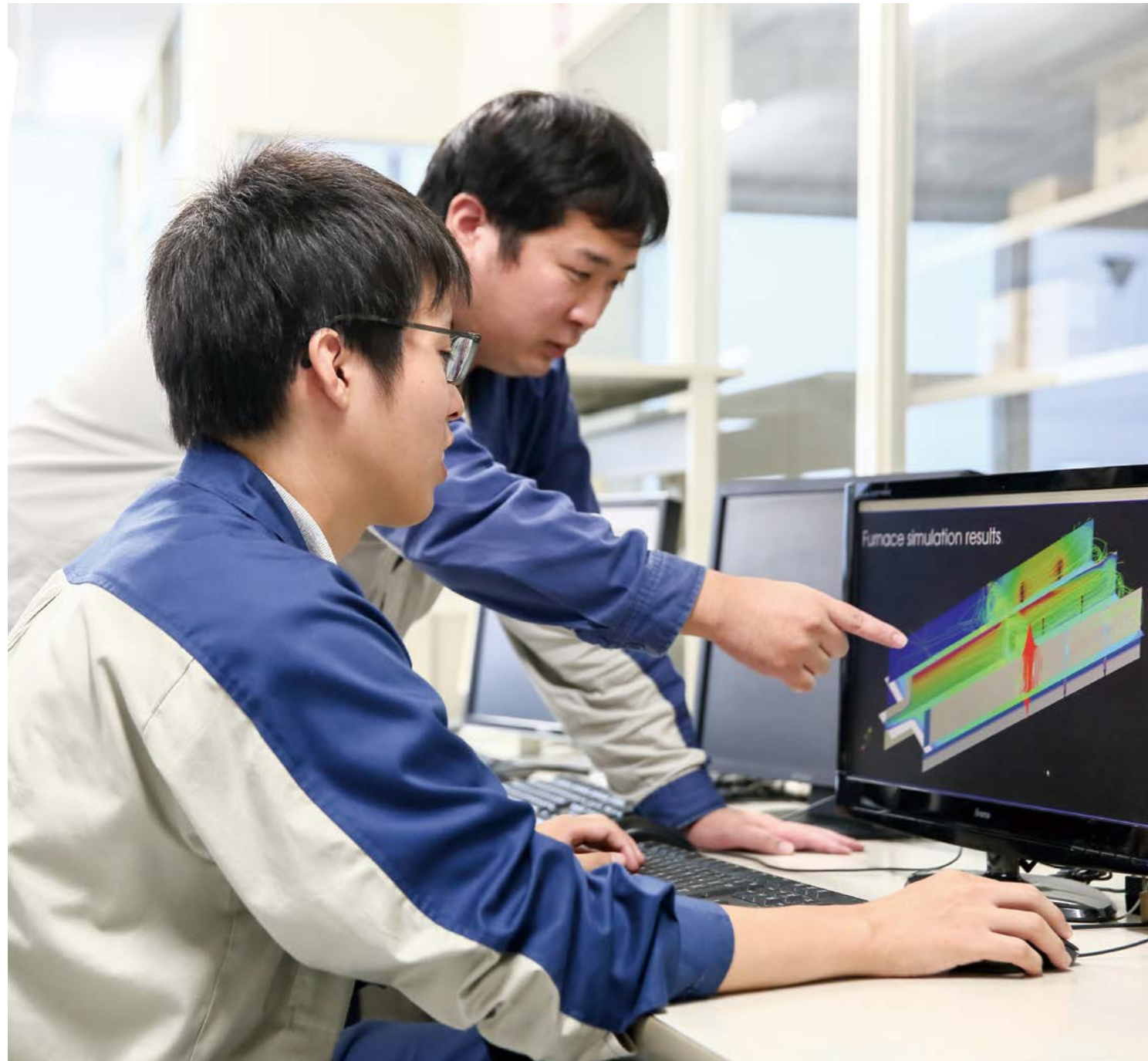
With excellent thermal shock resistance, mechanical strength, hardness, heat uniformity, and electrical properties, Neoceram is used all over the world. It is formed into plates, tubes, and pressed products, and used in cookware and wood-burning stove and fireplace windows. It can also be coated with thin heat reflective film.

StellaShine™, Super Heat-Resistant Glass-Ceramics for Cooking Appliances

StellaShine™ has excellent thermal shock resistance and does not crack even when splashed with cold water after repeatedly being heated to 800°C. StellaShine™ is used for top plates of gas and IH cookers, and is known for its safety properties.

Research & Development

Continuous innovation



R&D Policy

Our basic glass technologies consist of technology for material design, material evaluation, process design, and process development. We develop new products by combining these basic technologies with our applied technologies such as precision processing, forming ultra-thin glass, and manufacturing ultra-large glass. By focusing business development in growing areas such as automotive, ICT, medical care, and displays, we aim at developing glass that creates value for society.

Glass is a material that can be given various functions and shapes by customizing and modifying its composition and using various manufacturing methods. By incorporating a number of glass technologies and utilizing compound technologies, we have developed a wide range of high-function glass products.

R&D Organization

Our staff function departments engage in core areas of basic R&D such as the design of materials and processes and the development of evaluation technologies. Meanwhile the line departments carry out business sector development which includes improving products in our existing business sectors. The two sections collaborate on strategic development to create next generation business.

Intellectual Property

By steadily increasing the number of patents we own in Japan and abroad, and by actively utilizing cross licenses and other agreements, we reinforce the foundation of intellectual properties which is integral in our business strategies.

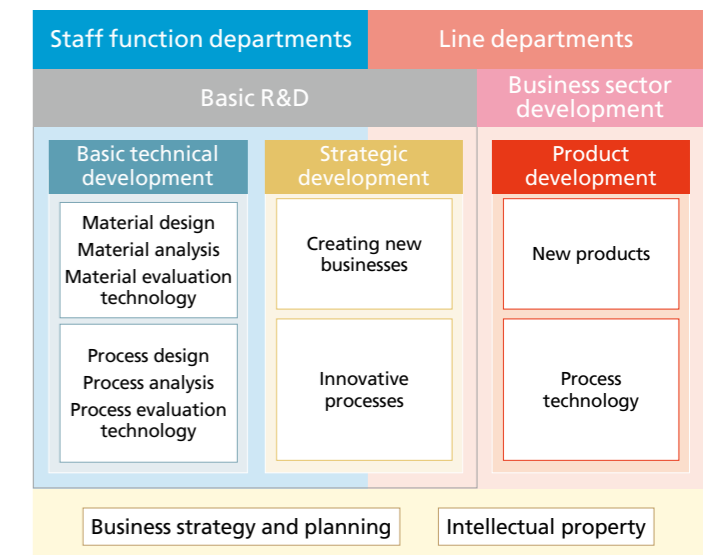


R&D Centers

P&P* Technology Centers carry out R&D of basic and applied technologies for glass manufacturing. The Otsu center primarily engages in material design, analysis and evaluation, and basic process analysis. The Takatsuki center focuses on development of processes and compound technologies to create glass with new functions.

*The term "P&P" stands for "Process and Product" and represents our philosophy of technology development: *Development of novel technologies and processes must be valued and the accumulated results of development will be reflected in the quality of our products.*

Collaboration between Departments



P&P Technology Center Otsu



P&P Technology Center Takatsuki

Glass Manufacturing Technologies

Over many years, Nippon Electric Glass has concentrated its efforts on developing a vast range of basic glass manufacturing technologies, including material design, evaluation, melting, forming, and processing. Through the accumulation of these technologies, we have developed new applied technologies to produce a variety of unique and high-function glass products.

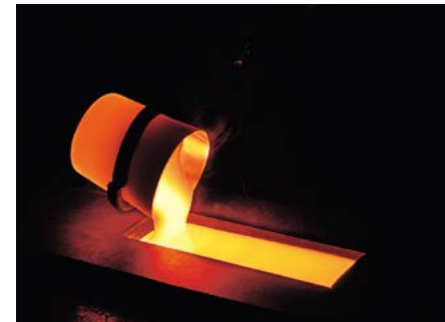
Material Design

Creating Characteristics and Functions

Glass can incorporate elements of nearly any material. Superior glass is created by altering its composition and achieving the necessary balance among its many properties. Glass materials evolve from a repeated process of composition modification, test melting, processing, and evaluation. We create optimal glass that can fulfill required performances.



Raw materials for making glass



Test melting

Process Technology

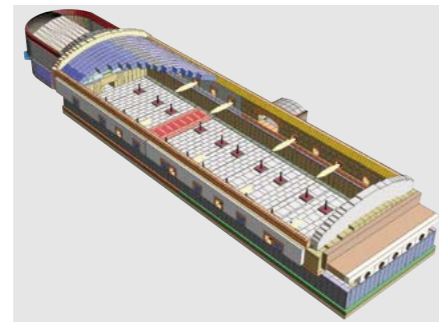
Melting

Uniform and efficient melting

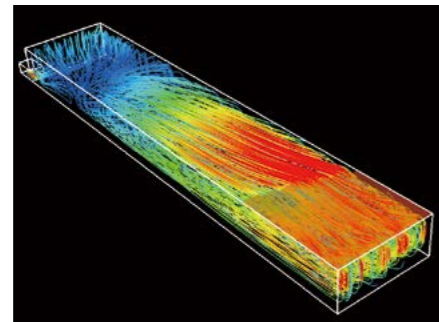
High quality glass requires precise furnace control technologies. Using our technology to design furnaces and glass melting, we create advanced and sensitive furnace operations through combustion control, thermal management, and other techniques also designed to reduce environmental burden.



Internal view of a melting furnace



Glass melting furnace

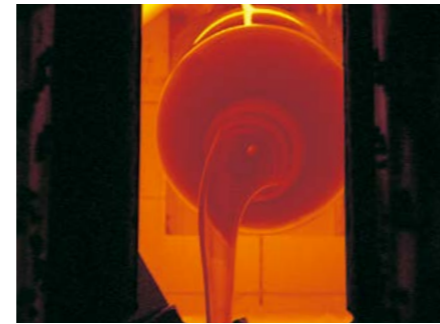


3D melting simulation

Forming

Creating required shapes with diverse techniques

A defining characteristic of Nippon Electric Glass is our extensive range of forming technologies. We accommodate diverse needs, achieving great dimensional precision and production efficiency by applying optimal forming processes for each product.



Tubing process



Overflow process



Blowing process

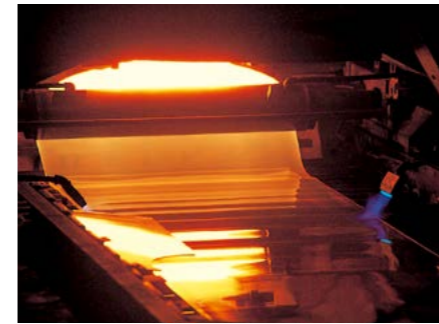


Pressing process

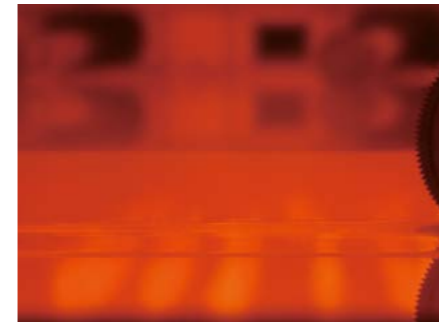
Processing

Adding new functions and properties to glass

Our range of processing methods includes glass reforming by heat, crystallization, and thin film coating on glass surfaces. Glass may also be precision-cut or combined with ceramics or organic materials. This produces even more precise shapes as well as new functions and properties.



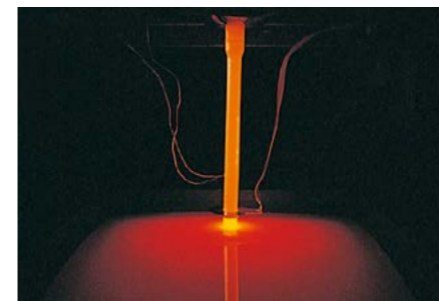
Rolling process



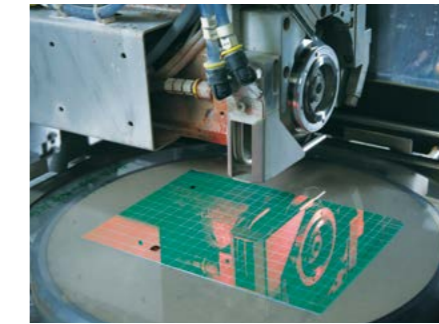
Float process



Spinning process



Casting process



Precision cutting



Fiber processing



Firing (crystallization)

Evaluation Technology

Analysis and Measurement

We have developed analytical technology that enables accurate analysis of even the slightest amount of hazardous substances in glass as specified in RoHS directives. Our Chemical Analysis Section received ISO/IEC17025 certification in 2006. The results of our analysis are accepted globally and ensure the quality of our products.



Chemical analysis



High-resolution scanning electron microscope



Birefringence imaging system

Functions of Special Glass

- Optical: light absorption, wavelength conversion, optical thin film
- Electromagnetic: insulation, dielectric, conducting film
- Thermal: heat-resistance, fire-prevention, low-temperature sealing
- Mechanical: high-strength realized through chemical strengthening or crystallization
- Chemical: acid-resistance, alkali-resistance, sustaining release of chemicals
- Other: gas barrier, strengthening plastic and cement

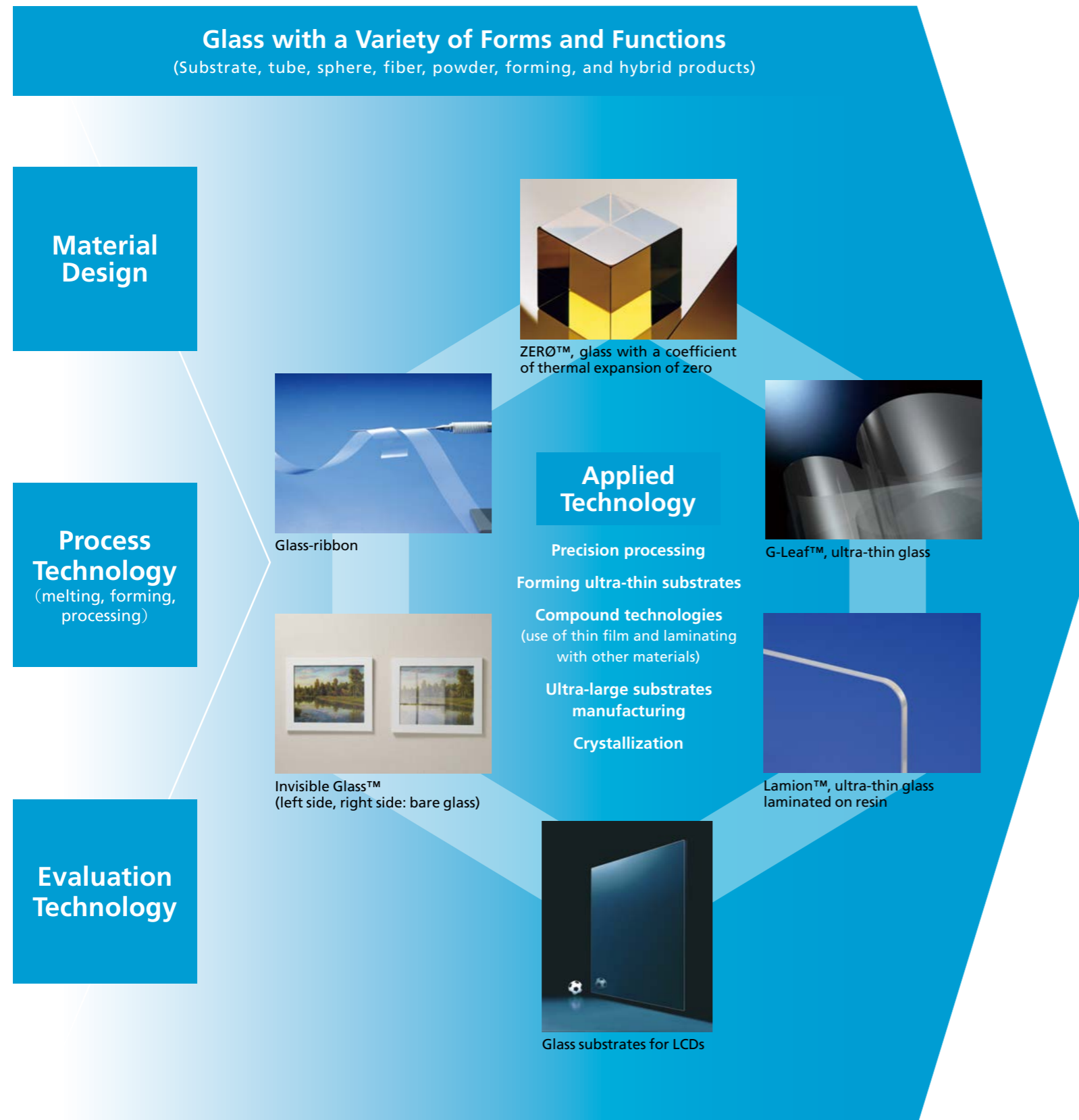
Processing Methods

- Precision cutting, precision polishing, pre-forming, firing (crystallization), fiber processing, powder processing, paste processing, green sheet processing, compounding, coating, patterning, precision redrawing, metallic joining, welding, sealing, accumulation process, perforation





Innovative Glass for the Future

Creating new values


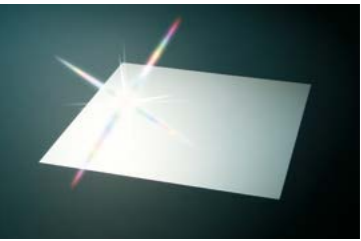


Nippon Electric Glass positions Automotive and Transportation, ICT and Semiconductors, Medical Care, and Displays as areas for expansion and reinforcement. Lighting, Energy, Social Infrastructure, and Home Appliances are strategic development areas. We provide value to markets by creating innovative products with great added value in these areas.



Expansion and Reinforcement Areas

<p>Automotive and Transportation</p> <p>Lightweight materials Vehicle lighting Displays Various sensors Electronic devices</p>  <p>E-Glass Fiber used in various engine components</p>	<p>ICT and Semiconductors</p> <p>High-speed and large capacity communication devices Next-generation semiconductors (Compact and high definition, advanced functions)</p>  <p>Glass for supporting semiconductor wafers</p>
<p>Medical Care</p> <p>Advanced medical containers Advanced medical equipment and facilities</p>  <p>Radiation-shielding glass used in IVR-CT facility</p>	<p>Displays</p> <p>Next-generation displays (High definition, thin, light, and flexible)</p>  <p>Glass substrate used in a LCD display</p>

Strategic Development Areas

<p>Lighting</p> <p>Next-generation lighting (Energy conservation, high-luminance, high-output)</p>  <p>Lumiphous™, phosphor-glass composite for high-power LED</p>	<p>Energy</p> <p>Power generation systems using natural energy (Solar power, wind, etc.)</p>  <p>Ultra-thin and lightweight solar mirror for power generation</p>
<p>Social Infrastructure</p> <p>High-functioning fire protective equipment High-performance structural material (Safe, durable, and lightweight)</p>  <p>ARG Fiber used in a bridge pier (under construction)</p>	<p>Home Appliances</p> <p>Sophisticated home appliances Housing materials Wall materials with multiple functions</p>  <p>Lamion™ used in a partition wall</p>

For Sustainable Growth

Realizing a society that respects diversity

We respect each employee's personality and diversity, and strive to create an environment where everyone can fully maximize their abilities. We are working to nurture human resources who can demonstrate their abilities in Japan and abroad.



Employing and Developing Global Human Resources

To address business globalization and the increased ratio of overseas sales and production, we employ people with global perspectives who can perform well overseas. At the same time, we have implemented a training system to help young employees succeed overseas in the future.

Employing People with Disabilities

In 1980, we established a special-purpose subsidiary to promote the employment of people with disabilities; we were among the first six companies in Japan to do so. We strive to expand employment opportunities for disabled people. We maintain an employment level that substantially exceeds the statutory employment rate for people with disabilities.



Greening activity in the factory

Work-Life Balance

We strive to create an environment where our employees can achieve a healthy work-life balance according to an action plan based on statutes promoted by the government. We encourage our male employees to take childcare leave and promote the continued employment of our female employees while reducing overtime and implementing other reforms.



Managerial position training (Korea)



Discussions with government officials (Head Office)

Training Programs

Category	Item
Training based on level	<ul style="list-style-type: none"> • New employee training • Young employee training (fifth year) • Mid-career employee training (tenth year) • Managerial position training (new managers) • Mid-level management training
Global human resources	<ul style="list-style-type: none"> • Global Communications Program (GCP) • Overseas training for newly hired administrative employees • Language training (English, Chinese, and Korean)
Skill-based training	<ul style="list-style-type: none"> • Intellectual property training • Accounting seminar • "Monozukuri College" to provide and enhance knowledge on manufacturing
Others	<ul style="list-style-type: none"> • Compliance training • Information security training • Self-development program • Seminar on "Unlimited Possibilities of Glass" for providing basic knowledge about glass

Nippon Electric Glass Fifth Action Plan

Goal	Content
1. Childcare leave Females: To achieve more than 75% utilization rate Males: To achieve more than 13% utilization rate of those whose spouse has given birth to a child	<ul style="list-style-type: none"> • Provide information regarding birth and childcare systems and related issues, and promote their use
2. Allowing use of paid leave on an hourly basis	<ul style="list-style-type: none"> • Study and adopt systems that meet employees' needs
3. Measures to reduce overtime	<ul style="list-style-type: none"> • Require each department to set overtime reduction targets and manage them
4. Promotion of use of paid leave	<ul style="list-style-type: none"> • Promote use of vacation time for significant days such as birthdays and anniversaries • Encourage employees who have not taken much paid leave to take more
5. Female invigoration project	<ul style="list-style-type: none"> • Encourage females to make proposals about corporate systems and support programs based on their own points of view

For Sustainable Growth

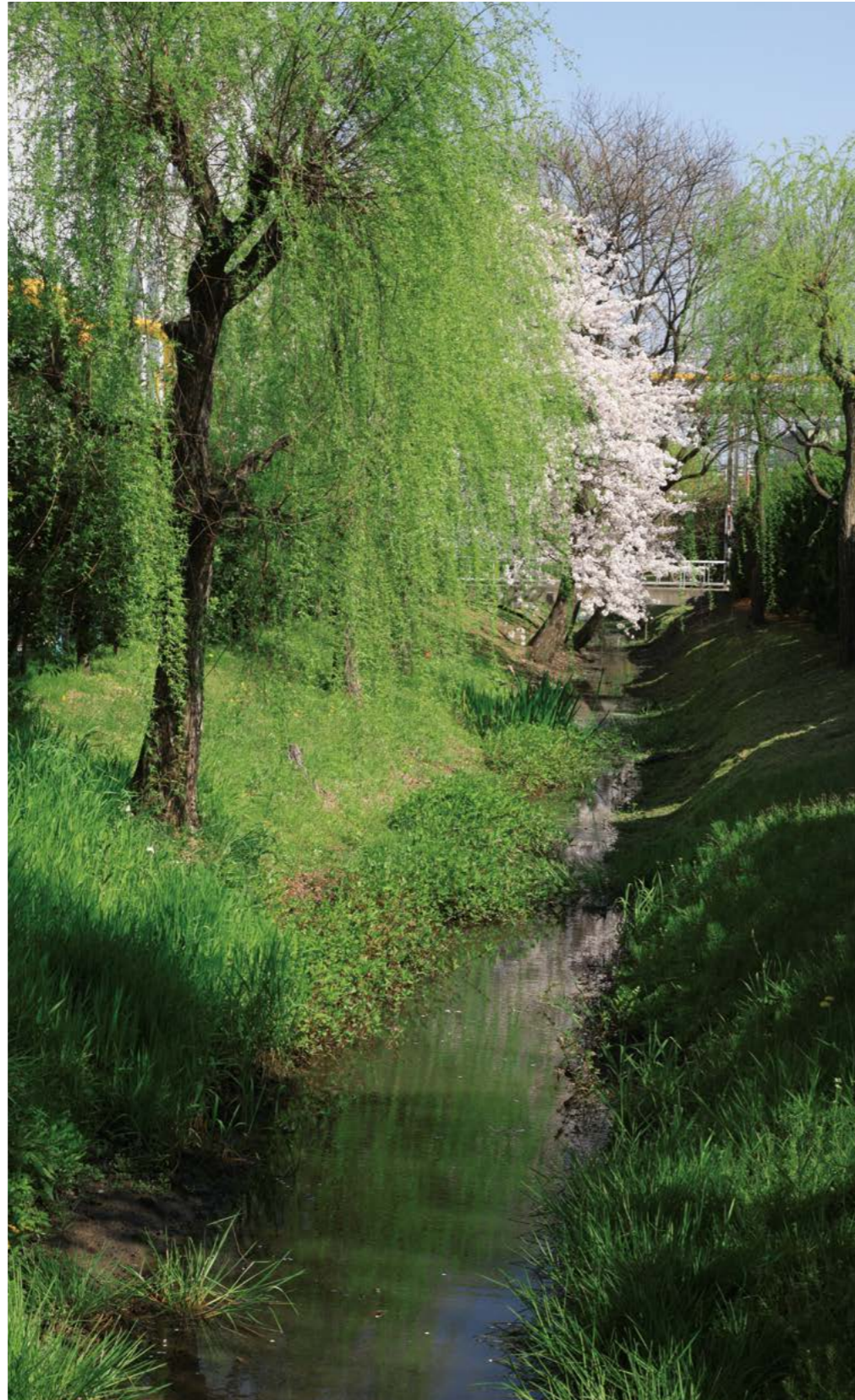
Striving for environmentally-friendly manufacturing

Business Plan for the Environment

We have been working on our Environmental Business Plan as a part of our environmental activities. This is an original activity that applies our concept for business operations to environmental conservation activities. We deploy and promote this activity company-wide with waste, water, and exhaust gas (reduction of evaporated glass components in glass melting furnaces) as our main themes.

Creation of a Workplace That Coexists with Nature

The Notogawa Plant was created with the concept of leaving nature "as is" except in places necessary for business activities. We maintain biodiversity by leaving the natural stream on the premises as it was at the time of establishment, and by maintaining the natural vegetation in the woods on our premises.



The natural stream which was there before Notogawa plant was established

A substantial amount of energy and resources are consumed when manufacturing glass. Therefore, we hold coexistence with nature as an important value and have striven to reduce our environmental burden. We also aim to contribute to local society and to harmonize and co-exist with the community as good corporate citizens.



Water processing plant



Oxygen generator



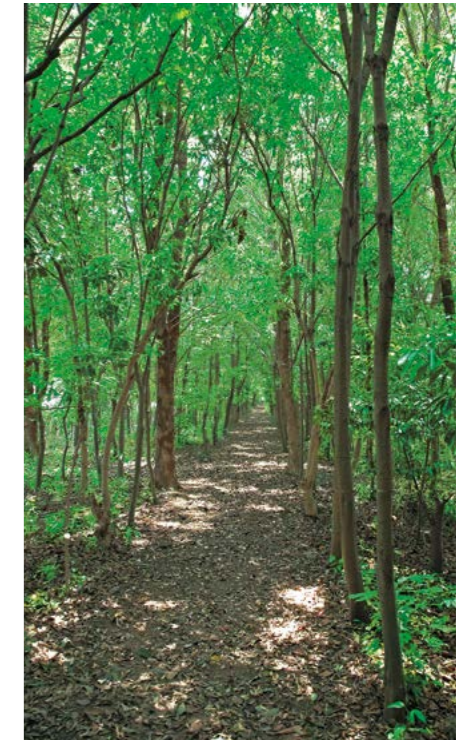
Collaboration with a local university



Recycled Material Glass (MG)*



Local kindergarteners visiting the company park



A path in the plant's natural woods

Shifting to Clean Energy

We have shifted the fuels used for our glass melting furnaces from heavy oil to LPG, and further to LNG, and increased the use of electricity, aiming to reduce carbon dioxide emissions and mitigate the environmental burden.

Waste Water and Exhaust Gas Treatment and Recycling

We purify waste water and exhaust gas, recycle purified water, and use materials collected from furnaces as raw materials for glass. MG* generated in the glass manufacturing process is returned to the furnaces. Our theme is 3R: reuse, reduce, and recycle.

Supporting the Development of the Younger Generation

As one way of contributing to local communities, we promote academia-industry collaborations by, for example, endowing courses at local universities. We also provide support activities such as having our employees address classes at elementary and middle schools.

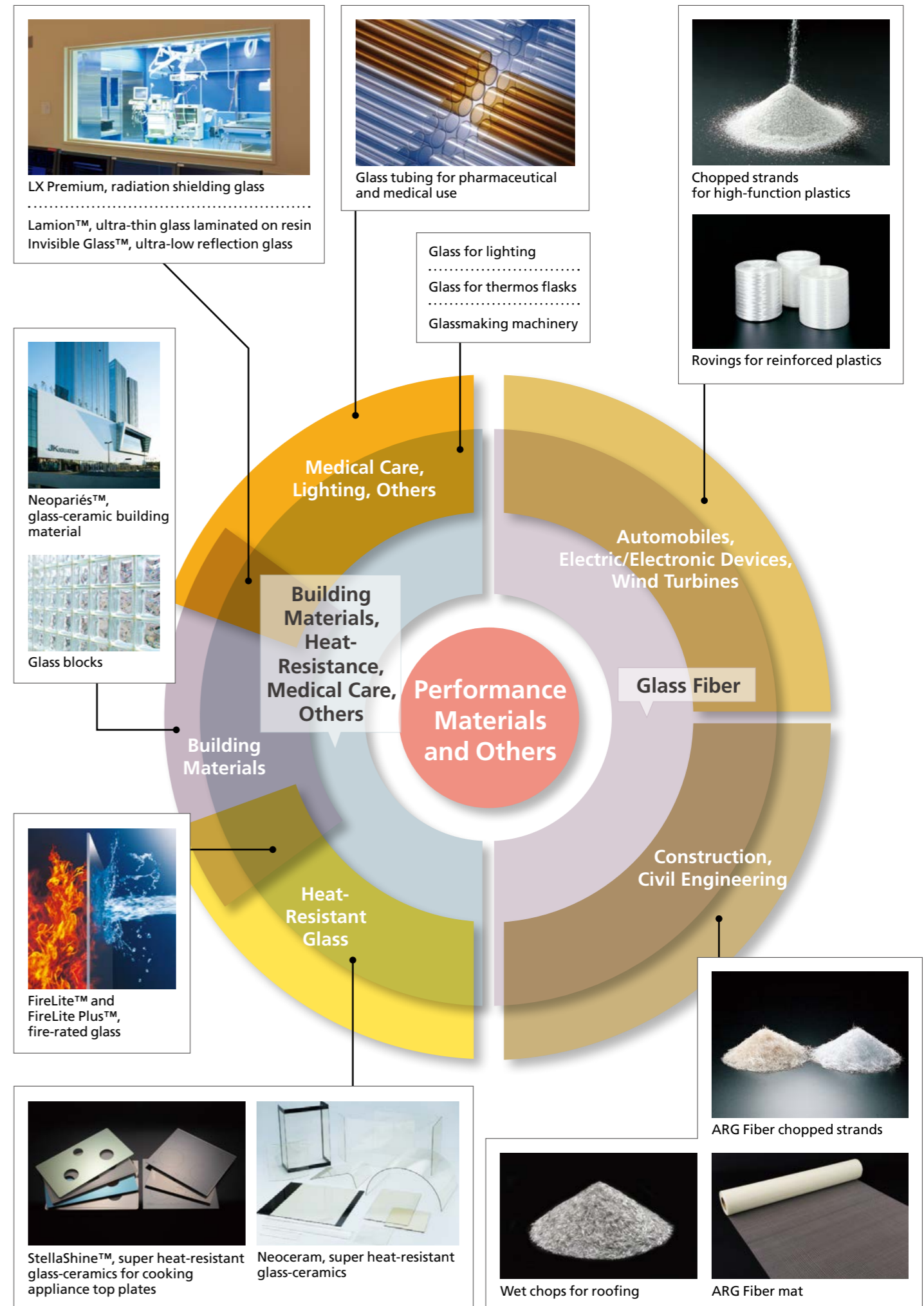
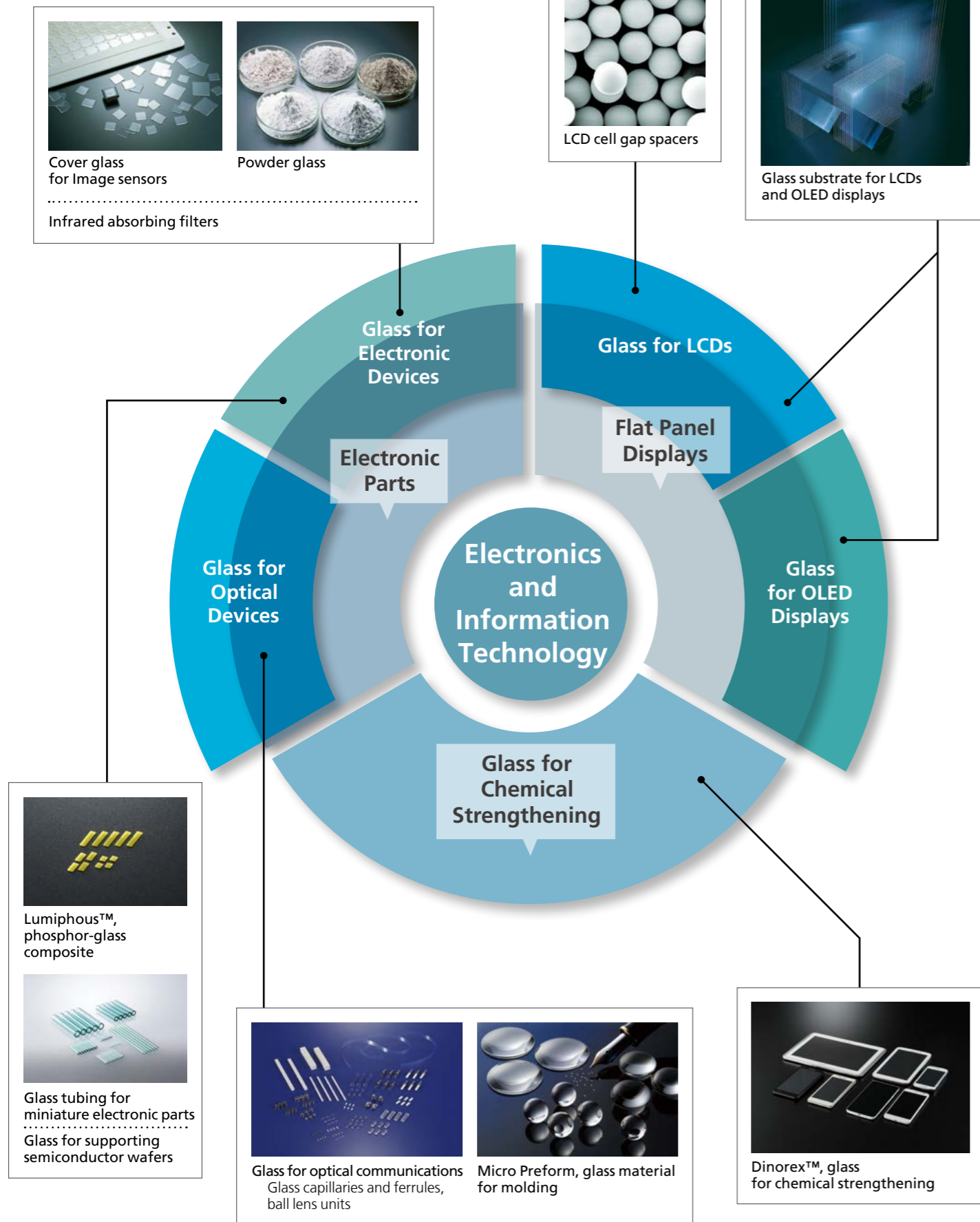
Co-existing with Local Society

We take active roles in local communities by performing volunteer activities such as cleaning and planting greenery around our workplaces, and inviting local residents to various events held by the company.

* We call cullets created during the glass manufacturing process Material Glass (MG).

Business Areas and Products

Our glass products are widely used throughout the consumer and industrial sectors.



History of Nippon Electric Glass

Since its establishment in 1949, Nippon Electric Glass has consistently developed and supplied new products to meet the needs of the era, dedicating itself to accumulating and refining glass manufacturing technologies. We will continue to pursue our efforts to seek world-class innovative glass manufacturing technologies and provide products which contribute to society.

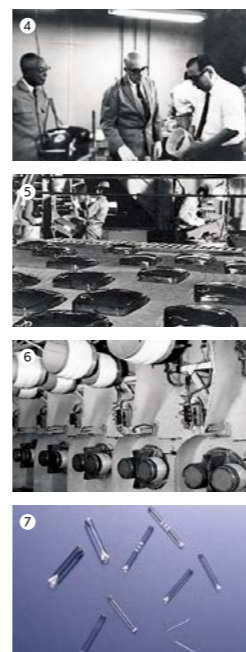
1944-1959 Creating Our Foundations

- 1944 Established in October in Otsu, Shiga Prefecture with investment from NEC Corporation and other companies. Loaned facilities to NEC following World War II and briefly suspended operations. (1945)
- 1945 Started production of hand-blown vacuum bulbs and lead glass for exhaust tubes as part of NEC Otsu Plant's glass department.^{①②}
- 1949 Separated from NEC on December 1 as an independent company. This is generally recognized as the day on which NEG was founded.
- 1951 Successfully began use of the Danner process to form glass tubing automatically; initiated mass production.^③
- 1954 Started production of glass tubing for ampoules.
- 1956 Started glass melting with a large tank furnace.
- 1958 Started production of glass for radiation shielding.
- 1959 Established Fujisawa plant.



1960-1989 The Growth of CRT Glass Business

- 1960 Introduced technology for manufacturing glass tubing from Owens-Illinois, Inc. of the U.S.A. (Introduced technology to make glass tubing for CRTs in 1963.)^④
- 1962 Developed Neoceram, super heat-resistant glass-ceramics.
- 1964 Established Shiga-Takatsuki plant.
- 1965 Started production of black-and-white CRT glass.^⑤
- 1968 Started production of color CRT glass.
- 1971 Established Notogawa plant.
- 1973 Company stock listed on the Tokyo Stock Exchange and Osaka Securities Exchange (Second Section). (Listing changed to First Section in 1983.)
Developed Neopariés, glass-ceramic building material.
- 1974 Started production of glass substrates for LCDs and Neorex, heat-resistant glass.
- 1976 Started production of ARG Fiber and E-Glass Fiber.^⑥
- 1981 Started production of glass capillaries for optical connectors.^⑦
- 1986 Developed low melting point powder glass for sealing ultra-LSI ceramic packages.
- 1987 Started production of thin sheet glass by applying the continuous redrawing process.
- 1988 Started CRT glass operations in the U.S.A. via joint venture (which was to become our wholly owned subsidiary in 1993).
Launched sales of FireLite, fire-rated glass-ceramics for use in fire protection zones.
- 1989 Made the U.S.A. representative office a sales subsidiary. Established Precision Glass Center.



1990-1999 The Era of Overseas Business Development

- 1991 Established Wakasa-Kaminaka plant.
Started CRT glass operations in Malaysia.^{⑧⑨}
- 1995 Started CRT glass operations in the U.K.
Started production of PDP glass substrates.
- 1996 Started production of glass tubing for LCD backlights.^⑩
Started CRT glass operations in Indonesia.
Started glass tubing operations in Malaysia.
- 1997 Started CRT glass operations in China (Hebei Province) via joint venture.
- 1998 Started glass fiber operations in Malaysia.
Started CRT glass operations in Mexico.
Started production of PDP glass substrates using the float process.^⑪
- 1999 Started heat-resistant glass operations in Malaysia.



2000-2014 The Era of FPDs

- 2000 Started production of LCD glass substrates using the overflow process.
Started CRT glass operations in China (Fujian Province).
- 2003 Started processing operations for LCD glass substrates in Korea (Gumi City).
- 2004 Started processing operations for LCD glass substrates in Taiwan.
- 2005 Successfully developed ultra-thin glass with a thickness of 100μm using the overflow process.
- 2006 Started processing operations for LCD glass substrates in Korea (Paju City) via joint venture.
- 2007 Started processing operations for LCD glass substrates in China (Shanghai) via joint venture.
- 2008 Developed OA-10G green glass substrate for LCDs, which does not contain any environmentally hazardous substances.^⑫
Successfully developed ultra-thin glass with a thickness of 50μm that can be rolled up on a cylinder. (Succeeded in developing ultra-thin glass with a thickness of 35μm in 2013.)^⑬
- 2009 Developed extremely thin Glass-ribbon made using the redrawing process.^⑭
- 2010 Started shipment of glass substrates for solar cells.
- 2011 Started production of glass tubing for pharmaceutical and medical use in Malaysia.
Started mass production of glass for chemical strengthening.^⑮
Established a sales subsidiary in Germany.
- 2012 Started sales of Invisible Glass™.
- 2013 Developed ZERØ™ glass with a coefficient of thermal expansion of zero.
Started melting and forming operations for FPD glass substrates in Korea (Paju City).
- 2014 Started processing operations for FPD glass substrates in China (Guangzhou).
Started development of parts for OLED lighting via joint venture with Saint-Gobain Group.



2015- For Further Growth

- 2015 Developed glass for supporting semiconductor wafers.^⑯
Enacted our new Corporate Philosophy Structure.
Started melting and forming operations for FPD glass substrates in Xiamen, China.
- 2016 Invested in NS Materials Inc. (quantum dot phosphor-composite devices business)
Started processing operations for FPD glass substrates in Nanjing, China.
Developed glass frit for laser-sealing of ceramic package.
Acquired European glass fiber operations (U.K., The Netherlands) from PPG Industries, Inc.^⑰
- 2017 Started FPD glass processing operations in Fuqing, China via joint venture.
Acquired U.S.A. glass fiber operations from PPG Industries, Inc.
- 2018 Developed high-efficiency deep UV-transmitting glass.
Developed an infrared absorbing filter with the world's highest visible light transmittance.^⑱
Developed the world's smallest optical isolator.^⑲



▶ Company- and business-related content is written in black.
▶ Product- and technology-related content is written in blue.

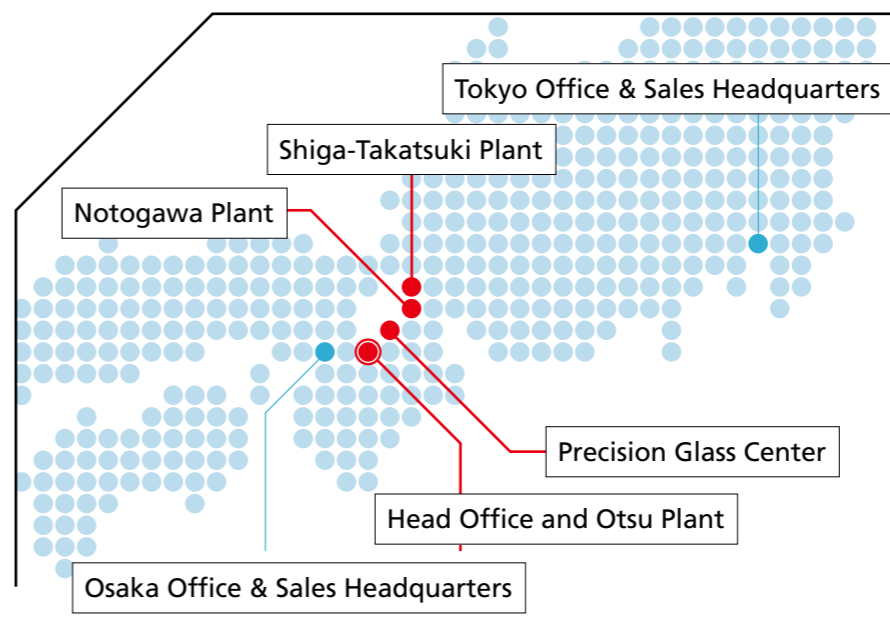
Global Network



Technology advances without limitation and Nippon Electric Glass will continue to innovate as the future unfolds. We are dedicated to providing products that make life better for people throughout the world.



● Manufacturing facilities
● Sales offices



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