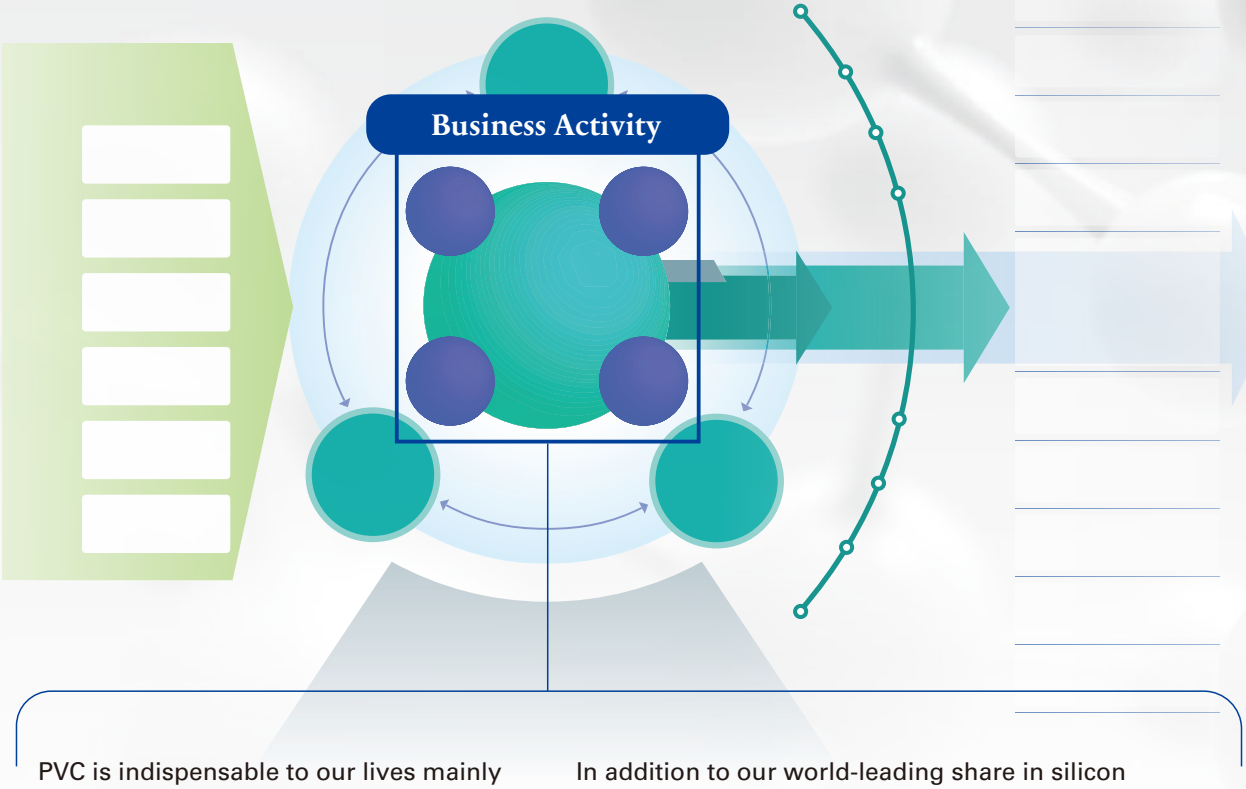
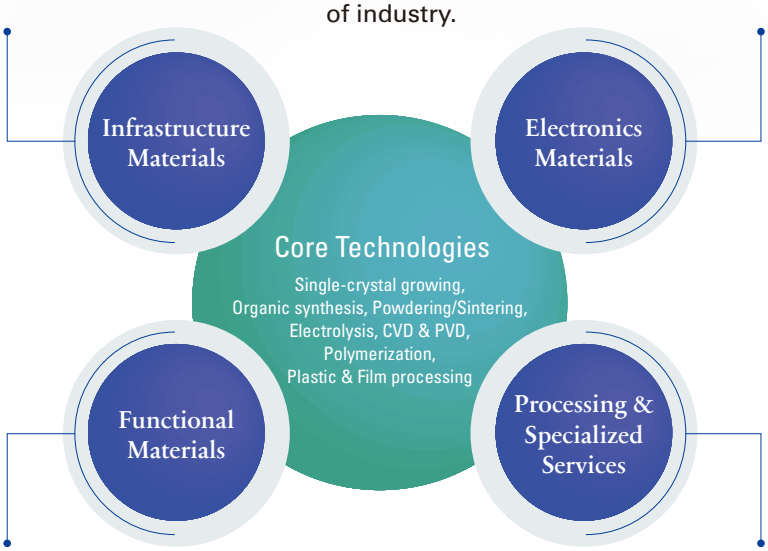
Leveraging our core technologies in four business fields to manufacture materials and products that underpin industries and livelihoods



PVC is indispensable to our lives mainly in the areas of infrastructure, housing, and agriculture. We meet global demand for PVC as the world's largest supplier.

In addition to our world-leading share in silicon wafers, we provide various materials that are essential for semiconductor manufacturing. We contribute to the digital transformation and green transformation of industry.



Along with more than 5,000 different types of silicones that support people's lives and industries, we provide a stable supply of high value-added products. We also help alleviate environmental impacts and food shortages.

Meeting the diverse needs of customers by leveraging the advanced technological capabilities developed by the Shin-Etsu Group.

Technologies, Materials and Products of the Shin-Etsu Group

The Shin-Etsu Group makes a wide array of products for use in a broad range of industrial fields by drawing on the production technologies accumulated in the process of continuously diversifying and improving its product offerings. By reciprocally maintaining close relationships, our business mix extends across many different fields and we have built a robust business structure impervious to economic conditions.

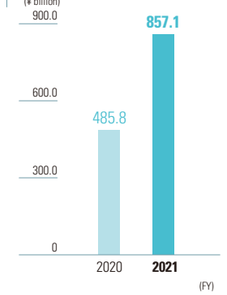
*1 Chemical vapor deposition (CVD)
A method for depositing thin film by chemical reaction on the substrate of precursors produced by applying energy such as heat, plasma, or light to raw material gases.

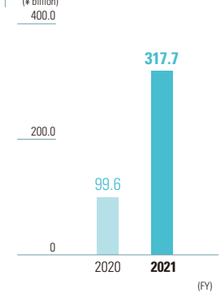
*2 Physical vapor deposition (PVD)
A method for adhering and depositing on the substrate surface by evaporating and scattering solid raw materials as atomic/molecular particles by heating, sputtering, ion beam irradiation, etc.

Business Overview

Infrastructure Materials

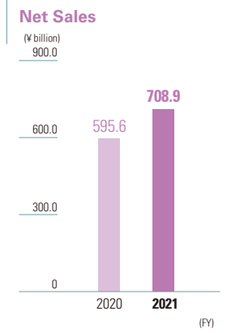
Demand for both PVC and caustic soda has remained strong and we hiked product prices to reflect the circumstances surrounding raw materials. In particular, with the exception of period for scheduled maintenance, all plants, including those of Shintech in the U.S., continued to operate at full capacity against a backdrop of housing shortages in major countries and fervent infrastructure demand in emerging economies.

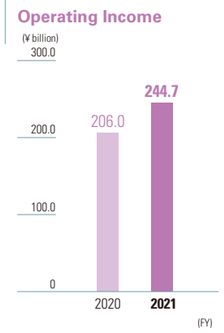




Electronics Materials

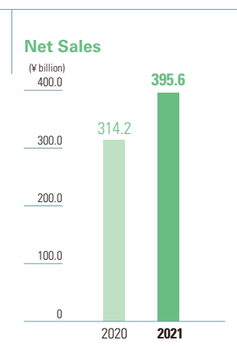
The global supply shortage of semiconductor devices remains unresolved. To meet strong demand from our customers, we shipped the maximum amount of semiconductor materials as possible, including silicon wafers, photoresists, and photomask blanks. Production of rare earth magnets was partially limited by governments' COVID-19 prevention measures and natural disasters affecting our production bases in Asia, but we made sure operations continued as much as possible in order to cater to brisk demand in all fields, including automotive, industrial equipment, and hard disk drives.

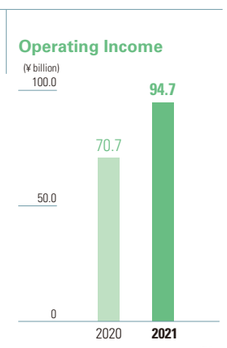




Functional Materials

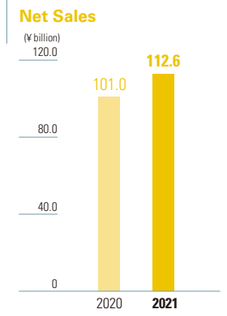
For our silicone product lineup, we expanded our silicon technology-based solutions, including products that help lower greenhouse gases emissions, and continued to beef up the resilience of our supply network. We also raised product prices in response to high raw material costs. At the same time, we brought to market many new and distinguishing products and made every effort to increase sales by striving to ship as much as possible even in the midst of distribution disruptions. We also took steps to raise prices on our cellulose products.

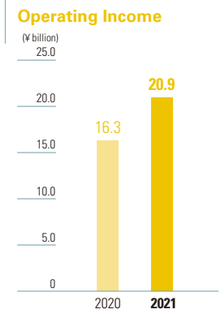




Processing & Specialized Services

Shipments of semiconductor wafer-related containers for both transporting use and manufacture process use, and sales of input devices for automobiles were also strong. Sales of PVC wrapping film for food packaging increased as a result of the consolidation of KitcheNista Co., Ltd.. We hiked prices for mainly silicone-related products and PVC-related products.





Business Activity

Infrastructure Materials

PVC is indispensable to our lives mainly in the areas of infrastructure, housing, and agriculture. We meet global demand for PVC as the world's largest supplier.

Business Overview

In the infrastructure materials business, we provide products indispensable to many aspects of our lives, from pipes for water supply and sewerage systems and other types of infrastructure to housing, agriculture, and daily necessities. These products include PVC, caustic soda, and polyvinyl alcohol (POVAL). PVC, in particular, is a general-purpose resin used widely as an infrastructure material in mainly construction and civil engineering in the form of piping for water supply and sewerage systems and window frames (PVC-framed windows), for example. With three production bases in the U.S., Europe, and Japan, the Shin-Etsu Group has the capacity to produce and stably supply the global market with 4.44 million tons of PVC resin each year.

Using Our Products to Solve Societal Issues (PVC)

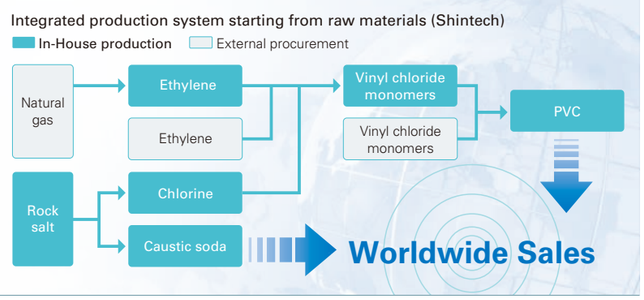
Protecting the planet by reducing greenhouse gas emissions and expanding social infrastructure to cope with population growth

- Salt accounts for roughly 60% of the raw materials used to make PVC and is a commodity that still exists in abundance throughout the world. As the production of PVC does not rely heavily on petroleum resources, it contributes to the effective use of the planet's limited resources. As such, CO_2 emissions during the PVC production process are lower than other plastics.
- The main applications of PVC are pipes and construction materials. Products made with PVC help conserve resources because they have a longer service life compared to other plastic products (PVC pipes last around 50 years*).
- PVC-framed windows boast superior thermal insulation and therefore help lower energy consumption and curb CO_2 emissions.
- PVC construction materials are much lighter than materials made from steel, for example, which leads to reductions in the amount of fuel required to transport them and move them into place during construction.
- In Japan, the material recycling rate for PVC is about 33%*, higher than that for other types of plastic.

*Source: Ministry of Land, Infrastructure, Transport and Tourism, Vinyl Environmental Council

Competitive Advantages (PVC)

- World's biggest production capacity
- Stable quality and stable supply to customers
- Favorable raw material circumstances in the US, Energy supply stability
- Integrated production system starting from raw materials (ethylene)
- Three global bases, and production at multiple sites in three locations in the U.S.
- Global sales network



Major Products and Applications

PVC

PVC is extremely durable and easy to work with. It can also be easily recycled. For these reasons, it is used widely in items related to our daily existence. For example, PVC pipes in water supply and sewerage systems help extend the useful life of such infrastructure because they do not need to be replaced for at least 50 years.

PVC Pipes

PVC-Framed Windows

Plastic Greenhouses for Agriculture

Caustic Soda

Caustic soda is a base chemical produced from the electrolysis of salt and is indispensable to various industries for the purpose of alumina extraction, as a raw material in lithium-ion batteries and super-absorbent polymers, and for water treatment.

Alumina

Cathode Materials for Lithium-Ion Batteries

Polyvinyl Alcohol (POVAL)

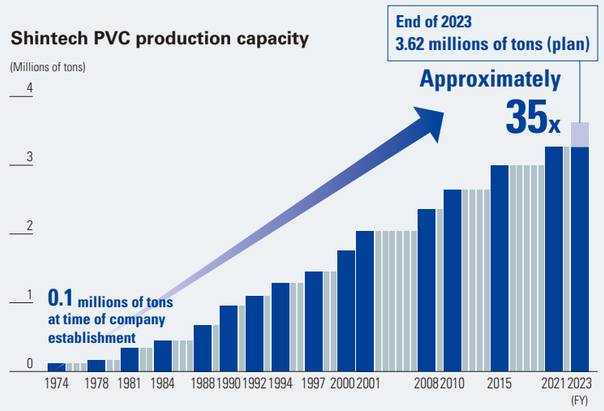
Polyvinyl alcohol (POVAL) has many applications, including adhesives, various types of film, textile treating agents, interlayers of laminated glass, and pharmaceutical additives.

Car Windshields

Topic

Shintech: Augmenting PVC production capacity

Shintech, one of the Group's subsidiaries in the U.S. and the world's largest manufacturer of PVC, boosted its annual production capacity to 3.24 million tons by bringing online a new plant with an annual production capacity of 290,000 tons at the end of 2021 to meet brisk demand in mainly North America and emerging countries. It also plans to complete the construction of a new plant with an annual production capacity of 380,000 tons by the end of 2023, thereby increasing its total production capacity to 3.62 million tons. In order to stably supply PVC to customers worldwide, in 2020 the company established an integrated production system starting from raw materials, chiefly by producing in-house some of the ethylene required for PVC manufacturing.

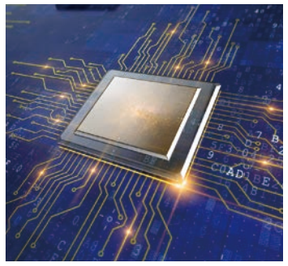


Electronics Materials

In addition to our world-leading share in silicon wafers, we provide various materials that are essential for semiconductor manufacturing. We contribute to the digital transformation and green transformation of industry.

Business Overview

In the Electronic Materials segment, we offer photoresists, photomask blanks, and encapsulant materials used in the semiconductor manufacturing process, while remaining at the forefront of the industry as the world's largest manufacturer of silicon wafers. In addition, we supply rare earth magnets, which are indispensable for reducing the size, weight, and power consumption of motors used in hybrid and electric vehicles, industrial equipment, and home appliances, as well as high-purity synthetic quartz used as a material for optical fiber and large-scale photomask substrates.



Using Our Products to Solve Societal Issues

Development of AI, 5G, automated driving, IoT

To achieve fully automated driving and telemedicine, 5G-compatible communication devices and infrastructure are necessary, and many high-performance, energy-efficient semiconductors are used in these devices. Silicon wafers, the substrate material for semiconductors, and various other semiconductor materials provided by the Shin-Etsu Group not only help to enhance performance and reduce the size and weight of electronic devices, but also contribute to improving electric power conservation and efficiency, thereby supporting the expansion and continuous growth of semiconductors on multiple fronts.

Providing technologies and materials essential for carbon neutrality

Rare earth magnets, which have about 10 times more magnetic force than conventional ferrite magnets, help enhance motor efficiency and power consumption, contributing to improved energy efficiency and reduced greenhouse gas emissions.

Competitive Advantages

Overall business	• Stable quality and stable supply to customers • Responding to increasingly sophisticated technological requirements
Semiconductor-related products	• Synergies gained from an extensive lineup of semiconductor-related products (competitive edge in development and proposal capabilities)
Rare earth magnets	• Stable supply supported by operating multiple production bases and an established integrated production system starting from raw materials • Development of products that substantially reduce the use of heavy rare earth materials and promotion of recycling

Shin-Etsu Group Products Associated with the Overall Semiconductor Manufacturing Process

Semiconductor manufacturing process

■ Processes where our products are used

Raw materials

Polysilicon is produced from silicon metal (Si), made by removing the oxygen from quartzite (SiO_2), as the base material.

Single crystal silicon

Single crystal silicon is produced in a cylindrical format by melting polysilicon.

Cutting and polishing

Single crystal silicon is cut into thin slices and polished to a mirror finish.

Silicon wafers

The processes shown above are used to create silicon wafers.

Wafers are shipped to device manufacturers.

CVD, Oxidation

Wafers are put into a high-temperature furnace to produce a thin oxidation film on their surface.

Pattern formation

Special photosensitive materials (photoresists) are applied, circuit patterns are baked in and developed, and the surface is processed. → P34

Dicing

Individual wafers are cut away and made into integrated circuit chips

Assembly

Using wire, the chips are connected electrically to a circuit board.

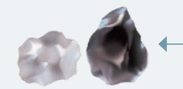
Resin sealing

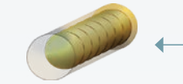
The chip is coated in resin to protect it from heat and shocks.

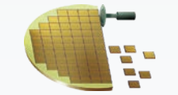
Semiconductor devices

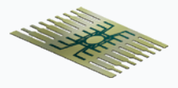
The completed semiconductor device is now embedded in the final product.

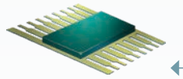
Final product

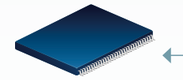












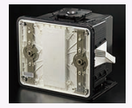
Products supplied by the Shin-Etsu Group

Silicon metal

Quartz crucibles

Silicon carbide fine-ground powder

Silicon wafers

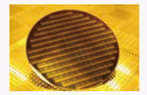


Wafer cases

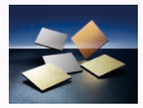
Rare earths (yttrium oxide)

Quartz glass for use in the semiconductor manufacturing process

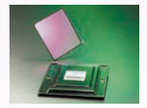
Synthetic quartz photomask substrates



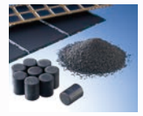
Photoresist



Photomask blanks



Pellicles (dust protection covers for photomask substrates)



Encapsulant materials

Liquid encapsulating materials

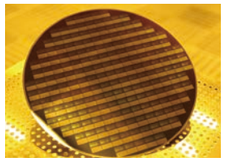
Thermal interface materials

Major Products and Applications

Silicon Wafers

Silicon wafers are the substrate material for semiconductors and are used in all kinds of devices, from smartphones, home appliances, automobiles and other devices that we see in our daily lives, to cutting-edge fields such as AI and IoT. Shin-Etsu Group's silicon wafers, including our quality control and evaluation analysis, have earned high praise from customers around the world, along with our high-precision single crystal technologies, high-end processing technologies, and high-quality epitaxial growth technologies for advanced logic and imaging devices.

Photoresists

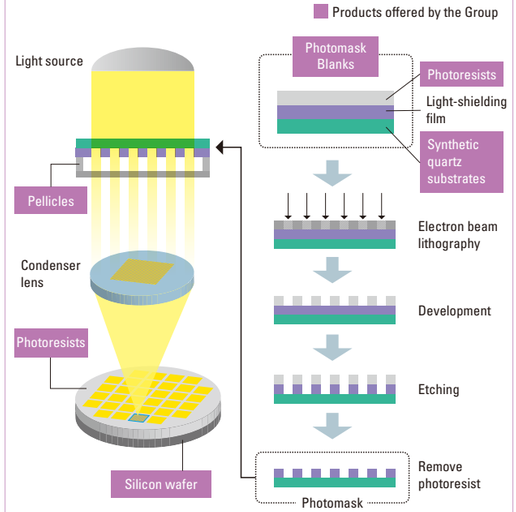


A circuit pattern is formed by applying a photosensitive resin to the surface of a silicon wafer and then passing light through a photomask to expose the surface in that pattern. In addition to photoresists for excimer lasers (KrF, ArF) and EUV, we also supply spin-on middle/under-layer hardmasks used in the nanofabrication process.

Photomask Blanks

Photomask blanks are the material that forms a thin metallic film on the surface of a synthetic quartz substrate and serve as patterning templates when drawing circuits on silicon wafers. In addition to providing photomask blanks for use with krypton fluoride (KrF) and argon fluoride (ArF) lasers, Shin-Etsu Chemical has established state-of-the-art photomask blank mass production technologies, including multilayer film structures and permeable membrane structures with excellent light resistance properties.

Semiconductor lithography process (pattern formation)



Rare Earth Magnets

Rare earth magnets are used in products such as automobile motors, power generators, industrial robots, compressor motors for air conditioners, motors for hard disk drives utilized in data centers and other facilities and wind power generator motors. Shin-Etsu Chemical is engaged in the manufacture of these magnets from the separation and refinement of rare earths as raw materials to processing. Furthermore, it is reliably supplying high-quality rare earth magnets with advanced features by means of the development of its own grain boundary diffusion method, which reduces the amount of heavy rare earth used, while maintaining high performance.

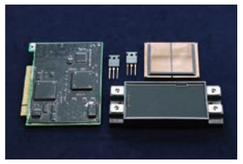
Electric vehicle

Data center

Rare Earths

Known as the "vitamins of the high-tech industry," rare earth elements are used in a variety of applications depending on their individual characteristics. They are used in the light-emitting devices installed in diagnostic imaging systems such as CT scanners and contribute to improved testing safety at medical sites.

Encapsulant Materials for Semiconductor Devices



These materials are notable for their superior heat and crack resistance and are used in general semiconductors, automotive power modules and devices for home appliances. Furthermore, the encapsulant materials we have developed for large-scale packaging improve the rate at which materials are effectively utilized, contributing to the reduction of device manufacturing costs.

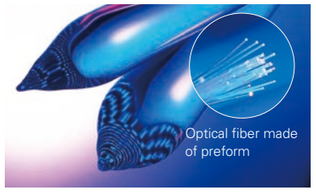
LED Packaging Materials

These materials offer high transparency, heat resistance, and other excellent properties, and help prevent the degradation of LED brightness over a long period of time.

Synthetic Quartz

Synthetic quartz, the key material of optical fiber, provides superior light transmission. In an ordinary glass plate, light attenuates in about two meters. However, synthetic quartz allows light to reach a distance of about 100 km. The Group was the first in the world to mass produce synthetic quartz, which is higher in purity than natural quartz. Due to these attributes, it is used as an optical fiber, a photomask substrate for semiconductor lithography and a stepper lens for semiconductor lithography. In addition, it is used as a large-scale photomask substrate for flat panel display (FPD) lithography.

Large-size photomask substrate for FPD



Preform for optical fiber

Topic

Enhanced photoresist production capacity in Japan and Taiwan

To meet the growing demand and technological evolution of photoresists, which are indispensable for advanced semiconductor manufacturing, we made capital investments totaling 30 billion yen at our production bases in Japan and Taiwan. In the summer of 2019, we started production of photoresist materials in Taiwan, one of the demand centers, to promote efforts to operate multiple production bases and improve supply stability. Furthermore, in February 2021, we added more facilities to boost our production capacity. We are also working to enhance capacity at our Naoetsu Plant (Niigata Prefecture) in Japan, completing construction of a new building in February 2022.

Shin-Etsu Electronics Materials Taiwan Co., Ltd. (Yunlin County, Taiwan), which increased its photoresist production capacity.

Topic

Began mass production of the SLK series of low dielectric constant thermosetting resins for 5G products

In response to the full-fledged rollout of the next-generation 5G communication standard, we have invested approximately 3 billion yen in preparing for mass production of the SLK series of low dielectric constant thermosetting resins. For the first phase, our annual production capacity is 80 tons. The SLK series is a high-strength, low-elasticity resin with low dielectric properties comparable to fluoropolymers, and will be used in electronic devices, circuit boards, antennas, radar domes, and other applications in the superhigh-frequency band of 5G. We will contribute to the development of next-generation high-speed communication technology by developing applications for the 5G market, which is expected to expand going forward.

Low Dielectric Constant Thermosetting Resins (SLK series)

Functional Materials

Along with more than 5,000 different types of silicones that support people's lives and industries, we provide a stable supply of high value-added products. We also help alleviate environmental impacts and food shortages.

Business Overview

The Shin-Etsu Group became the first Japanese company to commercialize silicone in 1953. Since then, we have developed over 5,000 different products that leverage the outstanding properties of silicone, and are now Japan's largest silicone manufacturer as well as one of the world's leading manufacturers. We also boast the largest market share in Japan for cellulose derivatives, which have a wide range of applications in the pharmaceutical, food, and industrial fields. Furthermore, as a major manufacturer with production bases in Japan, Europe, and the United States, we also cater to global demand. In the functional materials business, we provide a wide variety of products such as synthetic pheromones, silicon metal, liquid fluoroelastomers, and pellicles that deliver superior functionality that go beyond customer expectations.

Using Our Products to Solve Societal Issues

Low environmental impact of silicone

Silicone is made primarily from silicon, the second most abundant element on the earth after oxygen, making it less dependent on petroleum and thus less of a burden on the environment. Silicone's unique properties are used in environmentally friendly products such as electric vehicles, fuel-efficient tires, and solar power generation.

Addressing food shortages and environmental issues (cellulose derivatives)

Cellulose derivatives are an environmentally friendly material made from natural polymer cellulose. They help address the food shortage caused by population growth, with one of their uses being a binding agent for plant-based meat substitutes.

Improving food safety (synthetic pheromones)

Synthetic pheromones are an environmentally friendly agricultural pest control agent that has no impact on beneficial insects or other organisms, and helps improve food safety by reducing the amount of insecticides and pesticides sprayed on fields.

Competitive Advantages

Overall business	• Ability to develop a variety of high value-added products by leveraging our technological capabilities • High quality products and stable supply system
Silicones	• Thorough response to customer needs through the triangular link of sales, research, and production divisions • Use of advanced technological capabilities and know-how cultivated over approximately 70 years • Global production bases and a sales network in 12 countries • Continuous expansion of production capacity
Cellulose derivatives	• Stable supply system supported by three global bases

Major Products and Applications

Silicones

Silicone is a man-made compound created from silica stone, which is abundantly available on our planet. It is a highly functional material with unlimited possibilities, as it features both inorganic and organic properties and has numerous excellent characteristics, as well as a high degree of freedom in product design. Silicone is used in a wide range of fields, including electricals and electronics, automobiles, construction, cosmetics, healthcare, and foods.

Core raw material used in silicone	Silicone representative configurations	Major characteristics of silicone
		Heat resistance Cold resistance Adhesion properties Defoaming properties Electrical insulation properties Water repellency Release properties Weather resistance

Cosmetics

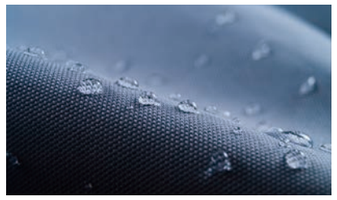
Electric Vehicles

Contact Lenses

Buildings

Plastic Products

Textile Treatments



Cellulose Derivatives

Cellulose derivatives are made from natural materials such as pulp and cotton linter. In the pharmaceutical field, it is used, for example, as a coating agent for pills to control where drugs dissolve in the body and to make them dissolve gradually. In industrial applications, cellulose derivatives are used as a molding aid for automotive emission filters, which contribute to the prevention of global warming, and in the food industry, it is used as an additive to thicken, gelatinize, stabilize bubbles and foam, and prevent deformation during cooking.

Pharmaceutical

Industrial

Food

Silicon Metal

Silicon metal is the main raw material for silicone, semiconductor silicon, and synthetic quartz, and is produced by SIMCOA Operations Pty Ltd in Australia.

Liquid Fluoroelastomers SHIN-ETSU SIFEL®

We were the first company in the world to succeed in developing the SHIN-ETSU SIFEL® liquid fluoroelastomers, which by using silicone addition-reaction technology can be made into a form that hardens into a flexible, solid synthetic rubber upon heating. It possesses excellent process ability and such superior properties as resistance to oils, solvents and chemicals together with good durability against heat and stability at cold temperatures, and is used in a wide range of fields, including automotive, aircraft, electronics and optical applications.

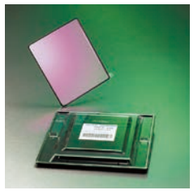
Anode Material of Lithium Ion Batteries

SiO is a greatly promising material as an anode material of next-generation lithium-ion batteries that have high capacity and excellent power properties. We have successfully improved battery performance by controlling the structure and surface of SiO particles.

Synthetic Pheromones

Synthetic pheromones are artificially synthesized from pheromones emitted by insects, and are used as environmentally friendly pest control agents as they obstruct the mating process between male and female pests, thereby suppressing reproduction.

Pellicles



We provide high quality pellicles for use as dust protection covers for photomasks used in both ArF and KrF excimer lasers. In addition to having excellent light resistance properties and uniform rates of light transmittance, our pellicles have been thoroughly treated to ensure low outgassing. With these attributes, our pellicles support the increasingly intricate production of semiconductor devices. Furthermore, we also mass produce ultra-large pellicles used in LCD panel manufacturing.

SOLBIN®

SOLBIN is a copolymer resin from Nissin Chemical Industry Co., Ltd. that is prepared primarily from vinyl chloride and vinyl acetate, which are notable for their superior adhesiveness and solubility. It is mainly utilized in paints, inks and adhesives.

Topic

Announced capital investment over 80 billion yen to expand production capacity, mainly in high-performance silicone products

As part of the 110 billion yen investment plan for the Silicones business announced in September 2018, we have expanded our production capacity for silicone monomers, an intermediate raw material, by approximately 1.5 times in Japan and Thailand. In addition, we also invested in functional products, which are the final products, as needed. However, in order to meet the strong demand for highly functional products, we decided to make over 80 billion yen in additional capital investments, mainly in our domestic plants. The new facilities will be used for a wide range of fluid-based, resin-based, and rubber-based end products. In addition, we will also promote initiatives to reduce environmental impact and contribute to advanced technologies, such as by newly installing equipment for molding silicone rubber that does not require post cure and equipment for prototyping micro-LED related materials, which will save energy and improve productivity.

Yokonodaira Plant at the Gunma Complex (Gunma Prefecture, Japan), where capital investment to expand capacity is underway.

Processing & Specialized Services

Meeting the diverse needs of customers by leveraging the advanced technological capabilities developed by the Shin-Etsu Group.

Business Overview

As a resin processing manufacturer that applies and deploys fundamental technologies in the areas of "materials and compounding," "design," "molding process," and "evaluation and analysis" for various resins such as PVC and silicone, Shin-Etsu Polymer Co., Ltd. meets the diverse needs of customers in a wide range of fields including the automotive, information equipment, semiconductor, packaging material, and construction material-related industries.

Shin-Etsu Engineering Co., Ltd. is involved mainly in the design and construction of the Group's manufacturing plants, and its engineering technology also has a strong reputation with customers outside the Group.

Using Our Products to Solve Societal Issues

- Creating a next generation mobile society by facilitating technological innovations in automobiles, such as the spread of automated driving and environmentally friendly vehicles
- Advancing IoT in society by developing communications infrastructure and improving the performance of facilities and equipment

Competitive Advantages

Shin-Etsu Polymer Co., Ltd.	• Comprehensive capabilities to handle everything from material development to processing as a member of the Shin-Etsu Group • Technological capabilities to create high-valued-added products with core technologies in processing various resins
Shin-Etsu Engineering Co., Ltd.	• Technological capabilities to handle design, construction, and maintenance of domestic and overseas plants in-house

Mainstay Products and Applications

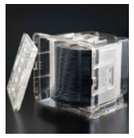
Shin-Etsu Polymer Co., Ltd.

Input Devices

Providing input devices for automobile steering, power windows, etc.

Wafer Cases

Providing cases for shipping silicon wafers and for inprocess wafer conveyance at device manufacturers.



Wrapping Films

Providing PVC wrapping films with superior stretchiness and excellent adhesive properties.

Topic

Acquired PVC wrapping film manufacturer and seller Kitche Nista Co., Ltd.

On August, 2021, we acquired all shares of Kitche Nista Co., Ltd., which took over the food packaging wrap business of Showa Denko Materials Co., Ltd. We will boost our competitiveness and further strengthen our business foundation by capturing synergies with Kitche Nista, which boasts strong market share in PVC cling wraps for food packaging and development expertise to create high-value-added products.

Shin-Etsu Engineering Co., Ltd.

Engineering

Shin-Etsu Engineering conducts plant design and construction and equipment maintenance for the Shin-Etsu Group.

Vacuum Assembling Equipment

Shin-Etsu Engineering also designs and manufactures vacuum assembling equipment for LCD panels, enabling large-scale liquid crystal panel production.

Micro LED Chip Transfer Equipment

This equipment transfers micro-LED chips quickly and accurately, thereby promoting the widespread use of micro-LED displays.