

PVC/Chlor-Alkali Business



Business Overview

Polyvinyl chloride (PVC) resins are general-purpose resins used in a wide range of applications from everyday products to all kinds of industrial materials. With three production bases, in the U.S., Europe and Japan, the Shin-Etsu Group has the capacity to produce 4.15 million tons of PVC resins each year.

Shintech, a PVC manufacturing subsidiary based in the U.S., started operation in 1974 at a production capacity of 0.1 million tons per year. Since then, Shintech has completed several expansion projects and become the largest PVC manufacturer in the world, with an annual production capacity of 2.95 million tons. In addition to establishing a new ethylene plant to ensure a stable supply of raw materials, Shintech is building an integrated plant that produces PVC from raw materials. By boosting production capacity in these ways, we will provide a stable supply of products to customers around the world.



Contributing to the Achievement of SDGs Through Product Supply

Approximately 60% of the raw materials used in PVC are salts, which are abundant throughout the world. Compared to other general-purpose resins, the benefits of PVC include a low dependence on petroleum resources, placing a relatively small burden on the environment. The process of manufacturing PVC from raw materials uses around 60% of the energy required to make other general-purpose resins. Highly durable and easy to recycle, PVC is used for a wide range of social infrastructure materials, including vinyl windows, water and sewerage pipes, public works and other construction.



Applications

PVC

PVC Pipes

Useful life of PVC water and sewerage pipes is more than 50 years, contributing to a long working life for infrastructure systems.



Plastic Greenhouses for Agriculture

PVC is easy to recycle. In Japan, more than 50% of the PVC sheet used for agricultural greenhouses is recycled.



Electric Wire Coating Material

PVC, which is superior in insulation properties, durability and pliability, and is hard to damage, is used as a coating material for electric wires.



PVC-Framed Windows

PVC is an excellent insulator, and PVC-framed windows can reduce the amount of heat lost through windows by 70% compared with aluminum-framed windows. These insulation properties help conserve energy by improving the efficiency of heating and air conditioning.



Siding Materials

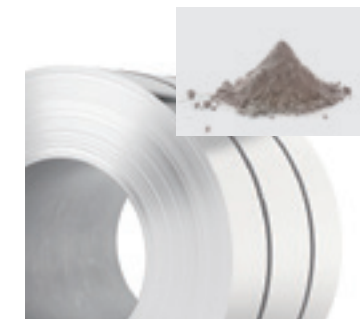
These decorative materials made from PVC are lightweight and easy to use for construction. They also provide excellent resistance to weather, shocks and corrosion.



Caustic Soda

Alumina

Aluminum hydroxide, made by dissolving bauxite with caustic soda, is a raw material for alumina (aluminum oxide).



Paper and Pulp

Caustic soda is used for digesting and bleaching wood chips in the dissolved pulp manufacturing process.



Cathode Materials for Lithium-Ion Batteries

Caustic soda is used as a raw material for the cathode materials used to produce lithium-ion batteries. These batteries are used in electronic devices such as mobile phones and laptops and electric vehicles, which are increasingly prevalent worldwide.



Super-Absorbent Polymers

These absorption agents are an essential element of paper diapers. Caustic soda is one of the raw materials used to manufacture super absorbent polymers.



Sodium Hypochlorite

Sodium Hypochlorite

Used to disinfect and protect the safety of foodstuffs and tap water, this material also helps prevent the spread of infectious diseases.



Semiconductor Silicon Business



Business Overview

The Shin-Etsu Group is the world's leading manufacturer of silicon wafers used as substrates for semiconductor devices. Consistently leading the way in terms of wafer purification and flattening technologies, the Group provides the market with superior products while continuing to steer the silicon wafer industry through achievements such as its early mass production of 300mm wafers and silicon-on-insulator (SOI) wafers that realize high speed and low power consumption. Furthermore, the Group has received high praise from customers throughout the world for its high-precision, single-crystal and high-end processing technologies; high-quality epitaxial growth technology for cutting-edge image sensor and logic devices; and quality management and evaluation analysis techniques. Responding to developments in technologies such as the IoT, AI, 5G telecommunications and automatic driving, we will further refine our own technologies and quality. We will also continue to ensure a stable supply of advanced silicon wafers that support the development and production of semiconductor devices.



Contributing to the Achievement of SDGs Through Product Supply

As a basic material supporting our high-speed information society, silicon wafers contribute to the improvement of electronic device performance, the miniaturization of electrical equipment and energy conservation. Silicon wafers are a particularly essential material in the automotive field, where they are utilized to reduce environmental impact, improve safety and automate vehicle operation. Power semiconductors are also useful for the stable supply of electric power, mainly to electronic equipment, as they can minimize power consumption and accommodate high voltage and high currents. The Group products are also used to accurately regulate motor drive controls from high to low speeds and used as power-saving transistors enabling the efficient transfer of power from generators to transmission lines.



Silicon Wafers

Electrical components for digital equipment and automotive parts

These items are used as substrate materials for semiconductor devices in smartphones, personal computers and other electronic devices; data centers; and automobiles.



Compound Semiconductor Products

LED components

Used in a wide range of applications including outdoor displays, traffic lights, in-vehicle stop lamps and sensor light sources.

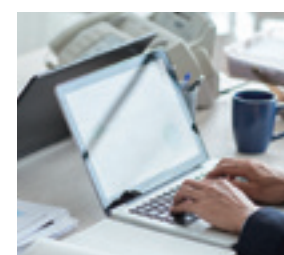


Applications

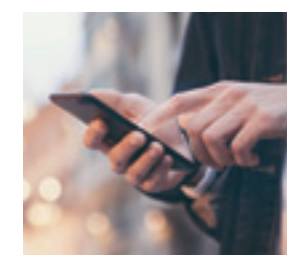
Communication/Computers



Data Center



Personal Computers



Smartphones

Automobile



Electric Vehicles



Hybrid Cars

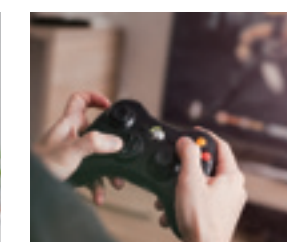


Car Navigation Systems

Consumer



Televisions



Game Devices



Smart Watches



Digital Cameras



Drum-Type Washing Machines



Energy-Saving Air Conditioners



Rice Cookers



Microwave Ovens

Industry



Industrial Robots

Other



Bullet Trains



Bank ATMs







Vending Machines

Silicones Business



Business Overview

The Shin-Etsu Group became the first Japanese company to commercialize silicone in 1953. Since then, the Group's share of the Japanese and global markets has risen due to quality, technological capabilities and meticulous response to the needs of the market. Silicone is a highly functional material that has both organic and inorganic characteristics and many superior features. The Group has developed more than 5,000 silicone products that are used in a wide range of industries, including electronics and electric applications, automobiles, construction, cosmetics, healthcare and food.

Core Raw Material Used in Silicone	Silicone Representative Configurations	Major Characteristics of Silicone
 <p>Silica Stone (SiO₂)</p>	<p>Fluids</p>  <p>Powders</p>  <p>Rubbers</p> 	<p>Heat resistance</p> <p>Adhesion properties</p> <p>Cold resistance</p> <p>Defoaming properties</p> <p>Electrical insulation properties</p> <p>Water repellency</p> <p>Release properties</p> <p>Weather resistance</p>



Contributing to the Achievement of SDGs Through Product Supply

Silicone primarily consists of silicon (Si), which is the second-most abundant element found in the outer layer of the earth's crust, behind oxygen. It is associated with a low dependence on petroleum resources and a low environmental footprint. Furthermore, it contributes to the achievement of sustainable societies, as it is used in solar power generation and other environmentally friendly products, including electric vehicles, eco tires and LED lights.

TOPICS

Development of “Reduced-Platinum Reaction Curing System Technology” That Contributes to Resource Conservation

Silicone release coatings used in seals, labels, adhesive tape and other types of release paper are generally created using platinum catalysts. However, platinum is expensive and because it is a rare metal, its use is associated with resource depletion issues. Our newly developed “Reduced-Platinum Reaction Curing System Technology” features a structure that is highly reactive with silicone, which enables curing with half of the conventionally required amount of platinum, thereby contributing to resource conservation.



Applications

Cosmetics

Improving the usability and functionality of various cosmetics to meet the diverse needs of the marketplace.



Buildings

Widely used as waterproof sealing material around window glass.



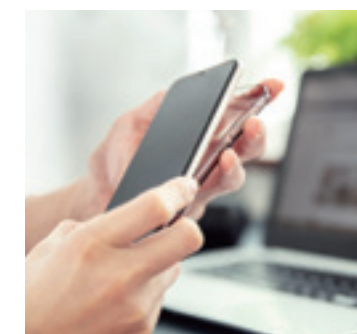
Lithium-Ion Batteries

Used in thermal interface materials found in lithium-ion batteries for electric vehicles and other devices.



Plastic Products

Utilized in resin modifiers, which raise the performance and effectiveness of plastic products.



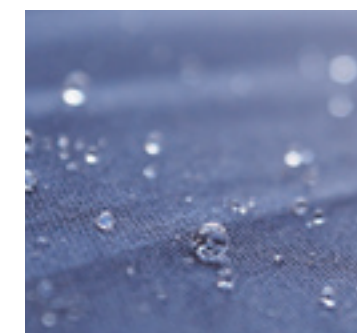
Contact Lenses

Essential as a material for contact lenses because of its oxygen permeability characteristics.



Textile Treatments

Adds functional attributes, including soft texture and water-repellency.



CPAP* Devices

Silicone is used in masks attached to CPAP devices, which help treat sleep apnea. Silicone is soft and easy on the skin, making these masks comfortable.

*Continuous positive airway pressure



Ship-Bottom Paints

Helps raise fuel efficiency by preventing marine organisms from attaching to ship drafts and contributes to the conservation of marine environments due to its high product safety.



Fuel-Efficient Tires

Silicone can lower rolling resistance and help improve fuel efficiency as a tire modifier.



Toys

Utilizing the safety and transparency of silicones, it is used as a material for toys.



Photograph provided by
SEGA TOYS CO., LTD.

Electronics & Functional Materials Business



Business Overview

We supply rare earth magnets, which are essential for reducing the size and weight of motors used in a variety of devices, including hybrid cars, electric vehicles, industrial equipment and home appliances. In addition, we provide photoresists, photomask blanks, encapsulation materials, pellicles and other products used in the semiconductor manufacturing process. Furthermore, we respond to the needs of advanced information societies by supplying products such as optical fiber preform and high-grade synthetic quartz used in large-scale photomask substrates for LCD and other flat-panel displays.



Contributing to the Achievement of SDGs Through Product Supply

Rare earth magnets have about 10 times the magnetic force of conventional ferrite magnets and are used to make motors more compact and lightweight and increase electrical power regeneration. These magnets help reduce greenhouse gas emissions while increasing the power efficiency of a variety of products, including environmentally friendly vehicles and energy-saving air conditioners.



Various types of rare earth magnets in shapes such as squares, rings and cylinders

TOPICS

Capital Investment Made in Response to Expansion in the Market for Photoresists Used in Semiconductor Manufacturing

Shin-Etsu Chemical has invested a total of ¥30.0 billion in its manufacturing bases in Japan and Taiwan to expand facilities for the production of photoresists essential to the manufacture of advanced semiconductors. Facility expansion associated with Shin-Etsu Electronics Materials Taiwan Co., Ltd. was completed in February 2021. Meanwhile, construction is under way at our Naoetsu Plant in Japan (Joetsu-shi, Niigata), and we aim to complete this construction by February 2022. As we move forward, we will further strengthen our business foundations as we respond to technological progress and the growing demand for semiconductor-related materials.



Shin-Etsu Electronics Materials Taiwan Co., Ltd. (Yunlin County, Taiwan)

Major Products and Applications

Rare Earth Magnets

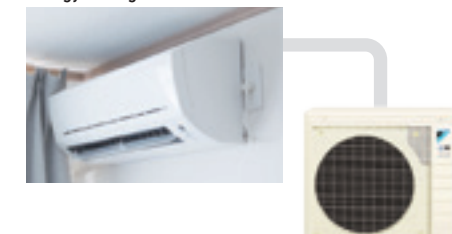
Rare earth magnets contribute to energy conservation and the reduction of CO₂ emissions and are used in products such as automobile motors, power generators, industrial robots, compressor motors for air conditioners, motors for hard disk drives utilized in data centers and other facilities and wind power 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.

Industrial robot



Photo provided by YASKAWA Electric Corporation

Energy-saving air conditioner



Hard disk drive



Offshore wind power generation



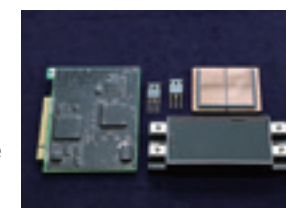
Rare Earths

Rare earths are used in the scintillators (light-emitting devices) installed in diagnostic imaging systems such as CT and positron emission tomography (PET) scanners. These elements benefit us in a variety of ways, including through their contribution to improved examination safety within 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.



Liquid (Paste-Like) Encapsulant Materials and Adhesives

These highly reliable materials and adhesives are designed for use with electronic devices. Epoxy materials that fall under this product category are used in general-purpose semiconductor devices; as encapsulants and adhesives in logic devices and electronic automotive devices; and as underfill material. Meanwhile, silicone materials are notable for their high transparency and excellent light resistance. Accordingly, they are used in LED lights and a wide variety of sensors (infrared sensors, pressure sensors, etc.) as encapsulants or adhesives.



Multipurpose Film Materials

Our multipurpose film materials have superior transparency and light resistance and are used for color calibration (color conversion) or as light diffusing film in LED lights and mobile phones. We provide an extensive lineup of film materials that fulfills the most cutting-edge needs and includes pliable and highly elastic film used for flexible devices, as well as low dielectric and low moisture absorption film designed for advanced substrates and high-speed communication devices.



Low Dielectric Materials

SLK resin

SLK resin has the lowest dielectric dissipation factor of any thermosetting resin and achieves extremely low levels of transmission loss when utilized in organic substrates for 5G and other high-speed communications technologies and as encapsulants for semiconductor devices.



Quartz fabric

Quartz fabric has dielectric characteristics that are ideal for use with high-frequency bands. A toughening agent (prepreg molding material) for high-speed communication equipment and antenna substrates, quartz fabric also is used in a wide variety of resin substrates, including thermoplastic and thermosetting resin substrates. It greatly contributes to improved communication performance in the high-frequency and high-speed transmission domains.



High-Purity Silane for Semiconductors

High-purity silane is used in the manufacturing process of semiconductor insulating films, epitaxial wafers and other commodities. Using sophisticated refinement technologies, we ensure stable supply of this product.

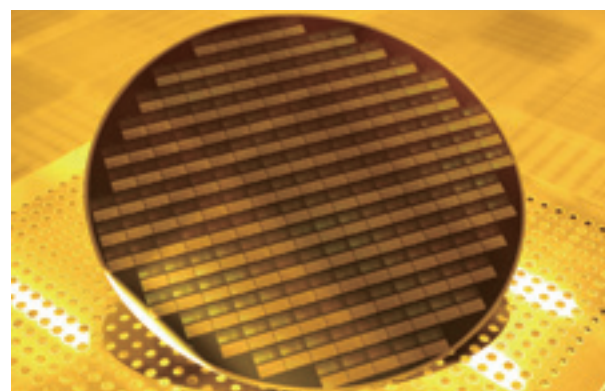


Electronics & Functional Materials Business

Major Products and Applications

Photoresists

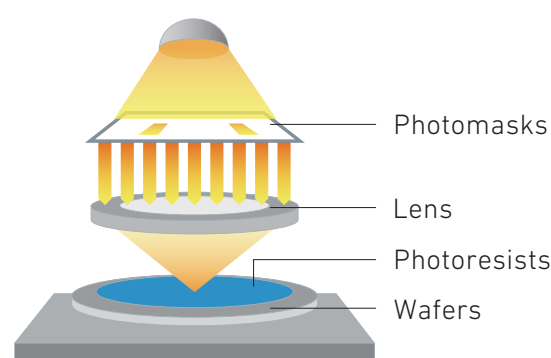
Taking advantage of its strengths as a material maker, Shin-Etsu Chemical carries out integrated manufacturing from the synthesis process of raw material polymer to compounding. We make photoresists for excimer lasers (KrF, ArF and EUV) that are used as photosensitive material for etching on semiconductor circuits, and our thick film i-line photoresists are used widely for thin-film magnetic heads and MEMS applications. Furthermore, for cutting-edge miniaturization processes we have lineups of multilayer material products. These are used as essential key materials in lithography processes for semiconductor manufacturing, and they help to enable the high integration, high speed and high functions of semiconductors.



Photomask Blanks

Photomask blanks are the material that forms a thin metallic film on the surface of a synthetic quartz substrate. Photomask blanks are the base material of photomasks, which serve as patterning templates when drawing circuits on silicon wafers during the semiconductor manufacturing process.

In addition to providing photomask blanks for use with krypton fluoride (KrF) and argon fluoride (ArF) lasers, Shin-Etsu Chemical consistently aims for higher performance and higher quality. Furthermore, we respond to the needs of device manufacturers by establishing innovative technologies used for the mass production of unprecedentedly advanced photomask blanks, including multilayer film structures required for the manufacture of cutting-edge devices and permeable membrane structures with excellent light resistance properties.



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. SHIN-ETSU SIFEL® 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.

SHIN-ETSU SIFEL® contributes to the improvement of products in a wide range of fields, including automotive, aircraft, electronics and optical applications.



Fluorinated Anti-Smudge Coating

Fluorinated anti-smudge coating is applied to the surface of eyeglasses and cover glasses/protective films for smartphones. A nano-scale fluorinated thin layer formed on the surface repels water and oil, and stains such as fingerprints can be wiped off easily. Due to its low dynamic friction, fluorinated coating contributes to improving the operability of smartphones. In addition, the Company supplies a fluorinated anti-smudge additive that can obtain excellent surface properties by adding to hard coatings.



Synthetic Quartz

Synthetic quartz, the key raw 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. Synthetic quartz contributes to the development of an advanced information society.



Synthetic quartz photomask substrates for LSI and FPD lithography

Oxide Single Crystals (Lithium Tantalite: LT)

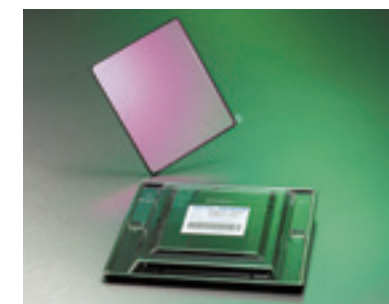
Lithium tantalite (LT) is used in mobile communication devices such as SAW* devices, which screen electromagnetic waves and pick up only specific frequencies. Oxide single crystals are currently contributing to the popularization of smartphones and serve an important role in our modern, increasingly information-driven society.



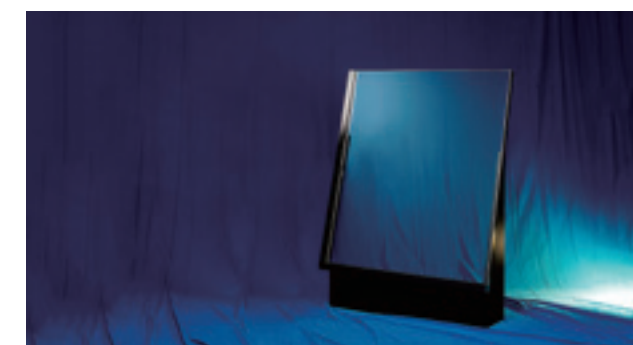
*Surface Acoustic Wave

Pellicles

Pellicles function as dust protection covers for photomask substrates. Shin-Etsu Chemical provides high-quality pellicles for use with 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 have successfully developed, and are currently mass producing, ultra-large pellicles for use in the manufacture of LCD panels.



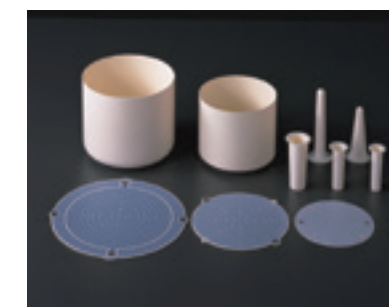
Preform for optical fiber



Large-size photomask substrate for 10.5th generation FPD

Pyrolytic Boron Nitride (PBN)

PBN is a high-purity ceramic with excellent chemical resistance and strength at high temperatures. Shin-Etsu Chemical was the first company to successfully produce PBN domestically. In addition to making use of PBN's excellent characteristics in crucibles for compound semiconductors and molecular-beam epitaxy, PBN's application fields are expanding to such areas as MOCVD systems and organic EL systems.



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. The Company has succeeded in putting electrical conductivity on SiO particles via our own proprietary method.



Specialty Chemicals Business



Business Overview

Cellulose derivatives, environmentally friendly materials made from natural polymer cellulose, are a core product of the specialty chemicals business. Cellulose derivatives are versatile, with applications ranging from such fields as pharmaceuticals and foods to materials for construction and civil engineering work, coatings, ceramics and toiletries. Currently, we have the largest share of the cellulose derivatives market in Japan and meet global needs as the world's foremost manufacturer with bases in Japan, Europe and the U.S. In addition, we provide synthetic pheromones used for agricultural pest control and the functional resin POVAL. We also provide a variety of other products, including silicon metal, a main ingredient in silicones, semiconductor silicon and synthetic quartz.



Contributing to the Achievement of SDGs Through Product Supply

Industrial cellulose derivatives reduce the separation of concrete in water, enabling concrete to be poured without polluting water. This contributes to environmental preservation by preventing water pollution. Synthetic pheromones are safe, environmentally friendly and eliminate agricultural pests. They are useful for making food safer through the reduction of insecticides and agricultural chemicals sprayed in fields.



TOPICS

Development of METOLOSE® MCE-100TS, a Binding Agent for Plant-Based Meat Substitutes

Plant-based meat substitutes are made using primarily soybeans and peas and are therefore gaining popularity among vegetarians and vegans. These substitutes are also attracting attention as a food product that is expected to help reduce food shortages caused by environmental issues and population growth. Shin-Etsu Chemical developed METOLOSE® MCE-100TS, one of its cellulose derivative products, while focusing centrally on its use as a binding agent for plant-based meat substitutes. Through the use of this binding agent, we successfully produced a texture similar to actual meat that was unachievable through the simple use of soybeans and other existing ingredients.



A plant-based hamburger steak made using METOLOSE® as a binding agent

Major Products and Applications

Cellulose Derivatives

Cellulose derivatives provide a variety of functions such as controlling the location where the drugs dissolve in the body and dissolving drugs slowly.

They are also used as a binder for the molding process to manufacture exhaust gas purifiers for automobiles. This technology contributes to the prevention of global warming.



Synthetic Pheromones

Synthetic pheromones prevent male pests from finding their partners. Obstructing their mating process in this fashion reduces the volume of agricultural pests.



Aroma Chemicals

Leaf alcohol is widely used in a variety of products, including aroma products, cosmetics and foodstuffs.



Silicon Metal

Silicon metal is a key raw material of silicone, semiconductor silicon and synthetic quartz. Simcoa Operations Pty. Ltd., our group company, manufactures silicon metal in Australia.



Polyvinyl Alcohol (POVAL)

JAPAN VAM & POVAL Co., Ltd. manufactures and sells this material. Due to its properties as a water-soluble synthetic resin, it is used in a wide range of applications such as adhesives, various types of films, fiber treatment agents, paper processing agents, and additives for cosmetics and pharmaceuticals.



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.



Processing, Trading & Specialized Services Business



Business Overview

Shin-Etsu Polymer Co., Ltd. develops and supplies products that are easy to use and highly functional products making use of materials processing technologies.

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

Major Products and Applications

Shin-Etsu Polymer Co., Ltd.

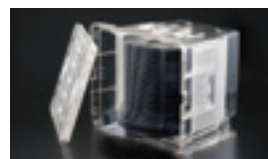
Input Devices

Providing input devices such as automobile dashboard audio and air conditioners.



Wafer Cases

Providing cases for shipping silicon wafers and for intra-process wafer conveyance at device manufacturers.



Silicone Catheters

Using our silicone processing technologies, we are providing increasingly intricate catheters.



Various Rollers for OA Equipment

Providing semi-conductive developing rollers and fuser rollers with proprietary processing technologies including conductivity, foaming and compositing technologies using silicone rubber as a raw material.



Wrapping Film

We provide PVC wrapping film with superior stretchiness and excellent adhesive properties.



TOPICS

Conducting Supply Capacity Enhancement in Response to Demand Associated with In-Vehicle Applications in India and Europe

Shin-Etsu Polymer Co., Ltd. is strengthening its ability to supply automotive input devices, which are core products. In May 2021, we completed construction on a third building in our production base in India, which was launched in anticipation of expansion in demand associated with vehicle electrification. Moving forward, we will target further business growth, mainly through response to demand related to in-vehicle applications within India and European markets.



The completed third building

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.



Technologies, Materials and Products of the Shin-Etsu Group

Using the production technologies it has amassed through its pursuit of further product diversity and sophistication, the Shin-Etsu Group has created a wide variety of products that contribute in a broad range of industrial fields.



Business segment

- PVC/Chlor-Alkali Business
- Semiconductor Silicon Business
- Silicones Business
- Electronics & Functional Materials Business
- Specialty Chemicals Business
- Processing, Trading & Specialized Services Business

*1 Chemical vapor deposition (CVD)

A process through which a film is generated by decomposing raw material gases using energy in the form of heat, plasma or light.

*2 Physical vapor deposition (PVD)

A process for evaporating solid raw materials into atomic or molecular particles using heating, sputtering or ion beam irradiation methods and subsequently scattering these particles onto substrate surfaces.

We have established a strong business structure that is resistant to impact from changes in economic conditions by maintaining close two-way connections through both raw materials and markets and producing materials used in a wide range of fields.