We contribute to the realization of a prosperous and safe society by providing materials used in a wide range of fields, from basic chemicals to cyanuric acid based high-performance materials.

In addition, we established a manufacturing and supply system for our high-grade urea solution AdBlue® that decomposes nitrogen oxide contained in exhaust gas from diesel vehicles, which is considered to be the cause of air pollution, into nitrogen and water, thereby reducing environmental impact.

* AdBlue® is a registered trademark of the Verband der Automobilindustrie.

### Fine Chemicals

Main products in this category consist of environmental chemicals, such as HI-LITE®, used for sterilization and disinfection of swimming pools and water purification tanks, and Venus® Oilclean, a microorganism formulation that decomposes oils and fats in wastewater from food factories, as well as the high-performance chemicals TEPIC®, derived from cyanuric acid that contains triazine ring, and melamine cyanurate (MC). These products are used for special applications. In addition to being used as a curative agent for coating powders, TEPIC® is seeing an increase in demand for use as an electronic material, for solder resist, LED sealants, etc. MC is used as a non-halogen flame retardant or an auxiliary flame retardant for various engineering plastics.

We are promoting research and development of proprietary cyanuric acid derivatives so that they can be used in a wider range of fields.

### Business Results and Outlook

![Graph showing business results and outlook](image-url)

Our Chemicals business was started with the manufacture of sulfuric acid and ammonia, materials for fertilizer. In addition to industrial use, we currently provide high purity chemicals for electronic component manufacturing applications and proprietary cyanuric acid derivatives for use in a wide range of fields.

We provide industrial chemicals such as melamine, sulfuric acid, nitric acid, and ammonia as well as basic chemicals, including our higher alcohol product FINEOXOCOL®, to a variety to industries. Nissan Chemical is proud of having the highest sales volumes for melamine not only in Japan but also overseas. Just as with our industrial chemicals, we are further improving the efficiency of our production system in order to create a stronger business structure to protect against external factors such as a rise in fuel prices.

We are also working on producing and supplying products to support cutting-edge fields, and introduce products to the market such as high-purity sulfuric acid, nitric acid, and ammonia from which impurities are removed as much as possible.

- **Natural gas**
- **Ammonia**
- **Urea**
- **AdBlue®**
- **Melamine**
- **Melamine cyanurate**
- **Cyanuric acid**
- **TEPIC®**
- **High-purity Nitric acid**
- **Chlorine**
- **HI-LITE®**

(Yellow boxes indicate chemicals procured outside the company)
The Chemicals business is susceptible to the effects of fuel prices, supply demand balance, and market conditions. Therefore, we will continue to strive to secure stable earnings while flexibly reviewing business strategies in response to environmental changes.

We are also focusing on the development and deployment of new products, mainly cyanuric acid derivatives, as a source of sustainable business growth, which have already been evaluated by many users for various applications.

1) We joined the United Nations Global Compact (UNGC) in April 2018 and have started initiatives for achieving sustainable development goals (SDGs) which focus on social and environmental issues that need to be solved by 2030. The Goal 6 “Clean Water and Sanitation” is still an important issue. We believe that the scenarios in which our environmental chemicals such as cyanuric acid and HI-LITE® can help with this issue will become increasingly widespread.

2) We have started exporting some grades of HI-LITE® since they have been certified as materials for disinfectants for drinking water in areas where hygiene management is insufficient, such as in developing countries. Preparations are being made so that we will be able to respond to expanding demand.

3) Our product TEPIC® has earned the trust of users and has become an indispensable product for many applications. We expect that demand for TEPIC® will continue to grow in various fields, including the information & communication field.

4) Demand for high-purity sulfuric acid is expected to grow in the information & communication field. As demand grows, we will continue to maintain high quality and high availability.

- New grades of TEPIC®
  - TEPIC-PAS: liquid product
  - TEPIC-VL: photo-curing product
- Starfine® (zinc cyanurate)
  - Adhesion improvement agent to metals
  - Additive for paints and adhesives
- Venus® Oilclean (microorganism formulation that decomposes oils and fats)
  - Decomposes oils and fats in wastewater from food factories and etc.
We will contribute to the realization of a smart society by promoting profitability of display, semiconductor, and inorganic materials and further expanding business size through new product development.

Display Materials

SUNEVER®, a coating material to align liquid crystal molecules in a certain direction, serves as our primary display material. Since 1989 when this product was made available for sale, we have expanded our market share by increasing the functionality of alignment materials, even when the liquid crystal type used is changed from TN to STN or TFT. In addition, we started the sale of Rayalign®, an alignment material for liquid crystal IPS which incorporates photo alignment technology, in 2014. This product is currently used in many smartphones that offer a screen resolution greater than 400 ppi.

It is expected that product demand for Rayalign® will further increase in the future as tablet and monitor resolutions increase.

Semiconductor Materials

We started the manufacture and sale of ARC® in 1998 based on a licensing agreement with US company, Brewer Science Inc. ARC® is a coating material designed to prevent issues such as light reflection, interference from substrate, and coating failure during micro-fabrication of the photosensit through lithography process. During the 2000s, semiconductor circuit widths were further miniaturized along and, in response, improvements were made to related materials. Therefore, we launched OptiStack® (multi layer process materials) in 2007 which greatly expanded our business.

Currently, in preparation for the expected demand for EUV (extreme ultraviolet) exposure technology (wavelength 13.5 nm, semiconductor circuit width 7 to 3 nm), we are developing EUV materials and also focusing on preparing materials for 3D packages preparing for the limits of optical shrink.

* ARC® and OptiStack® are registered trademarks of Brewer Science, Inc.

Inorganic Materials

SNOWTEX®, a colloidal silica solution serving as a fiber processing agent, went on sale for the first time in 1951. Now we offer organosol (colloid solution with nano-sized silica particles dispersed stably in organic solvent) and monomer sol, a product that can be used without solvent. These products are indispensable materials used as abrasives for manufacturing electronic recording media and for other purposes. We are aiming to further expand product applications, including use as an agent to increase shale oil and gas extraction efficiency.

Business Results and Outlook

Shale oil extraction site

We provide high-value-added products to the rapidly changing ICT industry through the three pillars of this business division: Display Materials, Semiconductor Materials, and Inorganic Materials.
Environmental Awareness and Stage II Business Strategies

Opportunities and Risks
- Increased demand due to the development of the information & communication field
- Change in demand for shale oil due to fluctuations in crude oil prices
- Advent of innovative technology
- Intensification of inter-corporate competitions

Main Measures
- Develop and launch new products
- Improve existing products and expand their application
- Strengthen evaluation technology
- Improve and maintain facilities

Sources of Growth
- Liquid crystal alignment materials for TVs
- Oil and gas materials

1) Currently, our liquid crystal alignment materials are mainly used in smartphones and tablets. In the future, however, we will use optical alignment technology that does not require rubbing and will also use it for TVs and other products with large displays.

2) Crude oil development is becoming more active in specific areas where superior shale oil wells are located and increasing shale oil production in those areas. However, it is said that extraction efficiency has been reduced due to the phenomenon that oil recovery amounts have generally decreased due to development in areas where wells are in close proximity. We aim to improve extraction efficiency by developing applications for use of our inorganic materials.

Efforts Started After Stage II Initiation

OLED materials
OLEDs are thinner and lighter than liquid crystals, offer high-speed response, and possess excellent design characteristics, such as flexibility. They are being used more often in smartphones, high-definition, large-screen TVs and other products. We are developing proprietary materials, including hard coat materials for surface protection, materials that enhance light extraction efficiency, anti-reflective coating alignment materials, and release layer materials, which contribute to improving the characteristics of smartphones. In addition, our company is also accelerating market development for ELsource®, a soluble hole injection material, NPAR®, a repellant bank layer material, and other materials which can contribute to reducing the cost of large TVs, production efficiency, and characteristics enhancement. We are also developing materials for next-generation self-luminous displays which will be the future display technology following OLEDs.

Semiconductor Packaging Materials
Technologies related to high-speed, large-capacity telecommunication such as IoT, 5G, and sensors, are making rapid progress. For this reason, further miniaturization and higher integration in the formation of electronic circuits are occurring. However, we are coming close to physical theoretical limits for shrinkage of interconnect and integration, so it is expected that issues will be overcome through further evolution of semiconductor packaging technology. In addition to circuit miniaturization, we have focused early on technology for three-dimensional stacking of thinned semiconductor wafers. In 2013, we acquired all shares of German company, Thin Materials AG and incorporated their advanced processes necessary for semiconductor packaging and material development technology, making them our own technologies. We are also actively working on other next-generation semiconductor packaging technologies and development of markets related to sensors.
We contribute to a stable food supply through consistent business activities from the research for new agricultural chemicals to their development, manufacture, and sale, and expansion of a broad product lineup through the acquisition of agents from other companies and joint development of products.

Since the 20th century, the world’s population has been increasing and is expected to increase from 7.4 billion (current population) to 9.6 billion in 2050. As a result, it is said that food production must be increased by about 60%, so how to increase crop yields on limited farmland is a major challenge for people’s survival.

The Agricultural Chemicals Division aims to increase crop yields by selling a wide range of herbicides, insecticides, and fungicides both in Japan and overseas for use on major crops worldwide.

**Agrochemicals**

Our agrochemical business was started in the 1910s when our predecessors Nippon Seimi Seizo and Kanto Soda began manufacturing and selling insecticides and fungicides. Initially, most of the active ingredients of our agrochemicals were introduced from other companies. However, starting with TARGA® (herbicide for grassy weeds) launched in 1984, we have continued to manufacture and sell products developed in-house such as SIRIUS® (herbicide for paddy rice), SANMITE® (insecticide/acaricide) and PERMIT® (herbicide for paddy rice and corn), which have steadily improved profitability.

Afterwards, we experienced hard times as a result of in-house development delays and intensifying competition created by domestic and foreign manufacturers. However, LEIMAY® (fungicide) was launched in 2008 followed by STARMITE® (acaricide) in 2009, marking our return to selling new products developed in-house.

In 2012, ALTAIR® (herbicide for paddy rice) was introduced to the market resulting in steady sales.

Additionally, we are actively pursuing the acquisition of other agrochemicals. For example, in 2002 we acquired Monsanto’s herbicide business in Japan and began selling ROUNDUP® and other products as our own products. In 2011, we developed ROUNDUP® MAXLOAD AL, a shower-type product that can be used as is aimed at households. In 2016, we started the sale of fast-acting “AL II” followed by “AL III”, which is both fast-acting and persistent, in 2018, striving to provide products to address customer needs.

**Veterinary Pharmaceuticals**

Through our development of agricultural pesticides, we have discovered compounds that are not only effective for use on agricultural crop pests, but also on fleas and ticks that are parasitic in dogs and cats, and have continued to study these compounds as veterinary pharmaceuticals. In 2008, we entered a licensing agreement with MSD Animal Health. Development of veterinary pharmaceuticals using Fluralaner, an active ingredient invented by our company, has advanced. Launched in Europe and the United States under the brand name BRAVECTO®* in 2014, veterinary pharmaceuticals containing Fluralaner as an active ingredient are now used in more than 100 countries and are leading the growth of our Agricultural Chemicals Division.

* BRAVECTO® is a registered trade mark of Intervet International B.V. and Intervet Inc.

**Business Results and Outlook**

Since the 20th century, the world’s population has been increasing and is expected to increase from 7.4 billion (current population) to 9.6 billion in 2050. As a result, it is said that food production must be increased by about 60%, so how to increase crop yields on limited farmland is a major challenge for people’s survival.

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At Nissan Chemical which consistently conducts research and development, manufacturing, and sales of agrochemicals, the ingredients that we develop in-house are major keys to increase profitability. Most recently, we launched GRACIA®, a product developed in-house, in 2018. However, it is necessary to create new products without compromising to current conditions. We are developing a fungicide (development code NC-241) and herbicide for paddy rice (development code NC-653) as new products and are continuing research with the expectation that these will become our next big products.

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2) We launched ROUND NOZZLE® ULV5, designed for use with ROUNDUP® MAXLOAD which uses only 5 liters of water to achieve 10a dispersion, which is expected to reduce farmer workload. As a result, we expect that ROUNDUP® will grow in demand as an agrochemical that is easier to use.

3) Along with factors such as the declining birthrate and aging population, the idea that companion animals are like a family to their owners is growing in popularity. We expect that the demand for veterinary pharmaceuticals will increase in the future as people become more aware about companion animal health.
By focusing on drug discovery and manufacture of active ingredients, we are striving to develop better pharmaceuticals through a unique business model that does not have a sales department, licensing products which we have developed to pharmaceutical companies.

Pharmaceuticals

In-house Drug Discovery

The development of the anti-hypertension agent efonidipine hydrochloride marked our start in the drug discovery business. It was launched as LANDEL® in 1994 in Japan. LANDEL® is distributed by Zeria Pharmaceutical Co., Ltd. and Shionogi & Co., Ltd. in Japan, and FINTE® is distributed by Green Cross Co. in South Korea. At the time of its development, drug development by major Japanese pharmaceutical manufacturers was focused on antibiotics while our company focused on (1) anti-hypertension agents and (2) anti-cholesterol agents, paving the way to success.

In 2003, Kowa Pharmaceutical Co., Ltd. launched LIVALO®, an anti-cholesterol agent, another one of our focus points, with the main ingredient pitavastatin calcium. Currently LIVALO® is sold in 25 countries around the world where it has been approved. However, in August 2013, its substance patent for Japan expired, and due to the decline in market share by generic drugs and the impact of drug price revisions, the domestic conditions continue to be harsh, and the creation of new drugs is an urgent need.

Currently we are developing a medication for thrombocytopenia (NIP-022) and an anti-arrhythmic agent (NTC-801), aiming to quickly advance to the next stages of development.

Finetech®

We are developing contracting business of technological development of pharmaceuticals for customers that provides total support to customers for their development of active pharmaceutical ingredients (API). We engage in the contracted development of manufacturing process in each one of the stages from pre-clinical to commercial production, as well as the contracted manufacture of API and intermediates in compliance with GMP (Good Manufacturing Practice). Furthermore, we provide related services including quality design, stability testing, impurity and metabolite sample synthesis, and creation of MF (Master File) application materials. In recent years, we have also started supplying generic drugs to meet the need for highly active drug substances that require fine organic synthesis and containment. We possess a wide variety of asymmetric synthesis technologies (epoxidation reaction, kinetic optical resolution, aldol reaction, Michael reaction, etc.), oxidation reaction technology using organic molecular catalysts (AZADOL® and IBS), and fine organic synthesis technology based on prostaglandin derivative synthesis through a proprietary two-component coupling method. We also have an abundant amount of experience manufacturing in-house medical pesticides, and our strengths include multi-step synthesis and heterocyclic compound synthesis.

Business Results and Outlook

We entered the pharmaceutical business in 1982 and launched EPATEC®, an external preparation with ketoprofen serving as its main ingredient, as our first pharmaceutical product. Since then, we have continued to deal with challenges in the R&D of innovative new drugs, making full use of our strategically developed chemical compound library, our cutting-edge evaluation functions, and our fine organic synthesis technologies, mastering the pharmaceutical business from manufacturing to sales.
Environmental Awareness and Stage II Business Strategies

Oppunities and Risks
- Revitalization of research for discovery of active ingredients for medical drugs
- Increased demand for generic drugs
- Intensification of inter-corporate competitions

Main Measures
- Creation and advancement of candidate drugs
- Expand our contracted manufacturing business and improve profitability

Sources of Growth
1) Sales promotion of eldecalcitol and generic drugs
2) Contracted peptide manufacture

1) In 2015, we started the manufacture and sale of maxacalcitol, an active ingredient used in medications for psoriasis and secondary hyperparathyroidism, supplying it for the manufacturer and seller of generic drugs. Also, the demand for eldecalcitol, an active ingredient in osteoporosis medications, is growing due to the increasing number of patients with osteoporosis resulting from population aging. Based on the production results of maxacalcitol, we will move ahead with the development of eldecalcitol, which requires stable and advanced quality control, establish a stable supply system for the product launch in 2020, and develop it as a source of business growth.

2) Constrained peptide pharmaceuticals have the advantages of antibody preparations and low molecular drugs and are expected to be new drugs that can be manufactured at low cost. We invested 900 million yen last year in a third-party allocation of shares of PeptiStar Inc., which is aiming to establish a stable supply system for API of constrained peptides. We will continue our research of new manufacturing technologies with the aim of dramatically reducing costs.

Efforts Started After Stage II Initiation

In addition to promoting the development of NIP-022 and NTC-801, we aim to license out drug candidate agents at the late stage of drug discovery. Also, drug discovery researches that are in their early stages are focused on neurological diseases. We will devote research resources to collaborative drug discovery research with Shionogi & Co., Ltd. and other pharmaceutical companies, and to nucleic acid drug discovery research with Luxna Biotech Co., Ltd. to increase the probability of success.

LIVALO® will serve as an important source for profits during Stage II as well. As pressure to control prices increases, we aim to maximize value with stable production results and high-quality APIs.

It will take time to acquire results in in-house drug discovery business. Until then, our Finetech business will support our pharmaceutical business. In addition to our maxacalcitol business, which contributed to Stage I profits, we will get our business up to speed in anticipation of the launch of the eldecalcitol as new generic drug in FY2020. Furthermore, we will start a contracted peptide manufacture in collaboration with PeptiStar Inc., a company in which we have invested, using our overwhelming technological advantages, including liquid phase synthesis. During the final year of Stage II, we will proceed with a full-scale plan to transform Finetech® into a highly profitable business.

Our pharmaceutical business will continue to boldly challenge in-house drug discovery while supporting the backbone of our highly profitable Finetech business.
Economic development and technological innovation have enriched people’s lives and made them more convenient. However, there are various challenges for a sustainable society, such as the declining birthrate, population aging, and progressing climate change issues.

We are making various efforts to create new businesses in order to contribute to a society whichUpreads health and longevity, an advanced information society, and an environmentally sustainable society.

**Life Sciences**

**FCeM® Series**

FCeM® series are the base materials for three dimensional cell cultures and serve as life science materials that enable preparation of cells efficiently and extensively. They are provided as Preparation Kit, Cellhesion®, etc. Preparation Kit can cultivate large amounts of iPS/ES cells by making suspension cultures possible. Cellhesion® enables mass culture of these cells as a scaffold for vaccines and antibody-producing cells and mesenchymal stem cells.

**NANOFIBERGEL®**

This is an additive that is friendly to people and the environment, consisting of fatty acids and amino acids. It can be blended into many cosmetic items. When added, it exhibits a moisturizing effect and promotes penetration of active ingredients.

This product is use in hair care products for hair and scalp protection.

**Information & Communication**

**SUNCONNECT®**

This is liquid organic-inorganic hybrid resin materials that exhibit high thermal stability and near-infrared transparency, and suitable for imprinting methods, photo lithography and other processes. It is used for optical interconnects for purposes such as optical waveguides and lenses for optical connectors.

**Environment & Energy**

**FairCurrent®**

FairCurrent® is undercoat material for lithium-ion batteries (LiB) containing highly dispersed nanomaterial. The thin film of FairCurrent® coated on current electrode enables LiB to improve energy density and life by reduction of electric resistance and increasing adhesion to electrode, and applicable for the automotive LiB.
Environmental Awareness and Stage II Business Strategies

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Efforts Started After Stage II Initiation

Life Sciences
We will accelerate development of the FCeM® series in Europe, the United States, and Asia, and aim to expand new applications of materials to establish a global standard for cell culture materials.

As for NANOFIBERGEL®, we will aim to expand the use of functional cosmetic additives to major cosmetic manufacturers in Japan and overseas, promote the development of new additives, and commercialize functional cosmetic additives.

AQUAJOINT® is a two-component mixed-type, room temperature solidified and stretchable hydrogel with water as its main component (80% or more), making it possible to make the most of the characteristics and properties of water. Its development is moving forward mainly for application and adoption in the life sciences field.

Information & Communication
With the launch of IoT and 5G services, the amount of data in optical communication networks is increasing, and the need for broadband optical modulators that convert large-capacity electrical signals into optical signals is expected to increase. Looking ahead at a future with such high-capacity optical transmissions, we are researching and developing polymer light-modulating materials that use the electro-optic effect to make such transmissions possible.

Environment & Energy
We are working on the development of materials that overcome high interface resistance which is a challenge in realizing new secondary batteries (storage batteries) that achieve both high safety and high energy density. While promoting joint development with automobile manufacturers and battery manufacturers, we are aiming for early commercialization of all-solid-state batteries.

In addition, the use of environmental energy, which has not been used thus far, is attracting attention as an increase in environmental awareness and as a sensor power source for IoT. Therefore, we are developing energy harvesting materials that convert environmental energy around us, such as light and heat, into electricity.

Furthermore, an energy-saving process is required for the dissemination of technologies for separating and collecting greenhouse gas that is emitted, which is expected as a measure against climate change. In order to achieve energy-saving processes, we are developing materials that advance membrane separation technology which helps reduce process size.