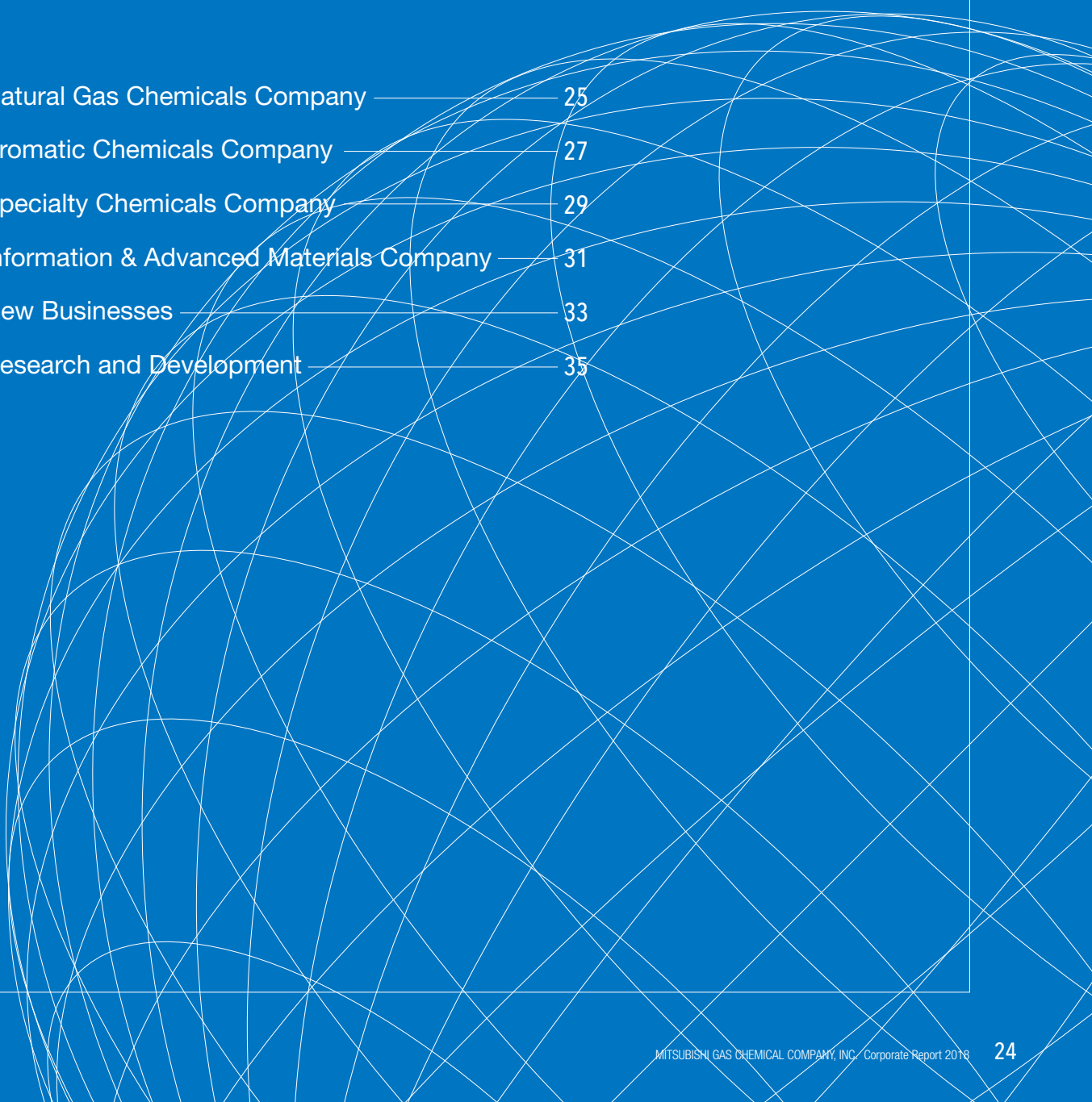
Growth Strategy



Natural Gas Chemicals Company

We are expanding our business areas more diversely and globally by taking advantage of our value chain, from resource mining to basic chemicals, derivatives and life science.

Business and Major products

Methanol, Organic Chemicals and Life Science

- Methanol
- Formalin
- Dimethyl ether (DME)
- Ammonia
- Polyols
- Amine
- Methyl methacrylate (MMA), Methacrylic acid (MAA), Methacrylate specialty esters
- Health food ingredients (PQQ)

Energy & Resources

- Mining and exploring for natural gas
- Developing geothermal energy

Review of Fiscal 2017 and the Medium-term Management Plan

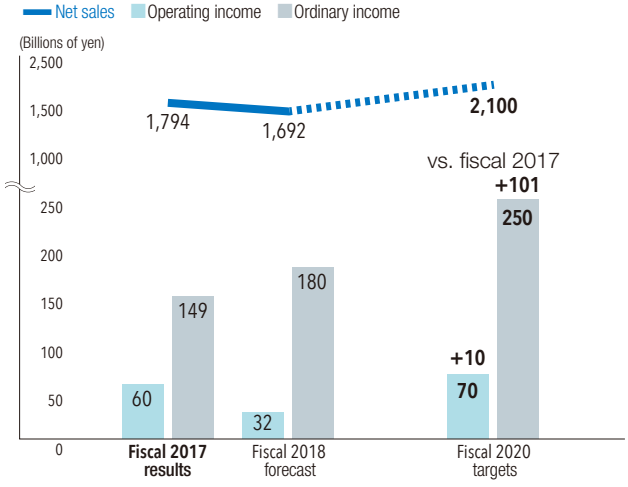
MGC's mainstay methanol business has maintained steady growth amid global growth in demand. In fiscal 2017, the Joint Venture Companies encountered unexpected circumstances, including trouble at a plant in Saudi Arabia and a change in the foreign exchange control system in Venezuela. Nevertheless, revenue increased substantially due to in part to rising methanol prices. The organic chemicals business achieved increases in revenue and earnings by strengthening its development of high-value-added products such as MMA derivatives.

Although the shale gas project in Canada recorded an extraordinary loss due to the cancellation of the LNG project, the Energy and Resources Business has made sound strategic moves that will lead to future growth, including its natural gas power plant in Soma, Fukushima Prefecture and the geothermal power generation project in Yuzawa, Akita Prefecture.

Since the life sciences business just started up in fiscal 2016, its contribution to performance was limited during the term of the plan, but we hope it will be a future pillar of our business.

Masashi Fujii
Director and Managing Executive Officer
President, Natural Gas Chemicals Company

Fiscal 2017 Results and Fiscal 2020 Quantitative Targets



Outlook

Planned figures for the Natural Gas Chemicals Company in MGC Advance2020, the new medium-term management plan that began in fiscal 2018, target a substantial increase in revenue and earnings in fiscal 2020, despite an expected decline in revenue in anticipation of a market decline in the first year.

The major driver of that increase is the start of commercial operation of the methanol plant in Trinidad and Tobago and the growth of the life sciences business centered on antibody drugs and healthy food materials. Regarding antibody drugs, the construction of the Niigata Plant of Cultivecs Inc., a joint venture with Nippon Kayaku Co., Ltd., was completed in February 2018. It has been attracting attention as a socially significant business that produces antibody drugs in Japan that had previously been imported from overseas. Health food materials such as SAMe (S-adenosylmethionine) yeast derived from natural sake yeast and SPD (spermidine) yeast, which is effective in maintaining and improving people's health, as well as PQQ (Pyrroloquinoline quinone), which is attracting interest both in and outside of Japan, are part of the successive development of products for which markets are expected to grow.

Growth Initiatives

The strength of the Natural Gas Chemicals Company is in its integrated business system that starts with natural gas. The business begins with the mining of natural gas, proceeding to the development and production of basic chemicals, such as methanol produced from natural gas as a raw material, and various organic chemicals that are derived from these. We believe that evolving and expanding this value chain is essential for our future growth.

In the methanol business, in addition to considering new locations to follow Trinidad and Tobago, we are focused on natural gas dissolved in water. The gas fields of the Niigata Plain, where that business is expected to be commercialized, are also one of the world's rare iodine production areas., and we will also look into the commercialization of iodine derivatives. As a basic chemical derived from natural gas, we will also venture into the hydrogen derivative business. In the energy field, we will contribute to enhancing the competitiveness of the Group by not only engaging in resource exploration, but also power generation and supply to our corporate group.

Focus

Methanol Plant in Trinidad and Tobago Scheduled to Start Commercial Operation in Spring of 2019

The Republic of Trinidad and Tobago is a resource-rich country with abundant reserves of oil and natural gas. MGC is proceeding with a project to construct facilities for manufacturing methanol and DME in cooperation with Mitsubishi Corporation and Mitsubishi Heavy Industries, Ltd. Construction of the plant has proceeded since the final investment decision was made in September 2015, with completion of the plant and the start of commercial operation scheduled for the spring of 2019.

The plant's annual production capacity will be on large-scale, at one million tons of methanol and 20,000 tons of DME. We expect to meet global demand growth and contribute substantially to the economic growth of neighboring countries and the increased business performance of our corporate group.

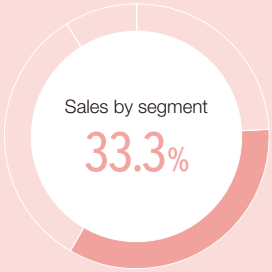
Functional Food Material PQQ Obtained the First Ever Anti-doping Certification in the Japanese Market

TPQQ is a type of coenzyme that assists enzyme functioning, and has been confirmed to have the ability to improve brain function, including enhancing memory and the ability to discriminate. Although it is generally produced through chemical synthesis, MGC produces it through biotechnology, and has succeeded in manufacturing it via fermentative production. It has been commercialized as the functional food material BioPQQ.

BioPQQ is said to be effective in strengthening the mitochondria, which produce energy in cells, and is used as a raw material for energy supplements. In March 2018, MGC obtained the first-ever anti-doping certification in the Japanese market. This will enable athletes to take PQQ without concern, and therefore we can expect to see it used more widely in sports supplements.

Aromatic Chemicals Company

We will achieve a business portfolio that enables sustainable growth based on high-value-added specialty chemicals and commodity chemicals as stable earnings bases.



Business and Major products

Aromatic Chemicals

- Meta-xylene
- Meta-xylenediamine
- MX Nylon (MXD6)
- Aromatic aldehydes
- Aromatic polycarboxylic acids
- Purified isophthalic acid (PIA)
- Phthalic anhydride
- Plasticizers

Foamed Plastic

- Expanded polypropylene
- Expanded polyethylene
- Molded products

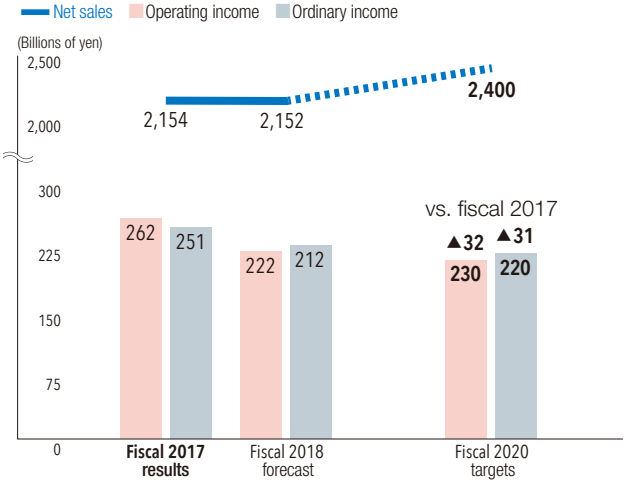
Review of Fiscal 2017 and the Medium-term Management Plan

Despite several years of declining profitability, after implementing business structural reforms, we rebounded to become a profit driver of the MGC Group.

In fiscal 2017, our mainstay commodity chemicals (Meta-xylene and PIA) achieved a significant increase in revenue and earnings due to a sharp rise in PIA market prices, which has increased demand for plastic bottles, and the expansion of meta-xylene production. Sales volumes for specialty chemicals such as MXDA, its derivatives, and aromatic aldehydes have expanded, mainly in markets outside Japan. As a result, revenue and earnings increased in 2017. In contrast, earnings of the foamed plastics business developed by Group company JSP declined due to rising raw material costs, despite higher sales.

Masato Inari
Director and Managing Executive Officer
President, Aromatic Chemicals Company

Fiscal 2017 Results and Fiscal 2020 Quantitative Targets



Outlook

Commodity chemicals such as meta-xylene and PIA are major sales drivers, but we see a risk that the spread between market prices and raw material costs will affect earnings. This spread has been favorable in recent years, but is expected to contract in fiscal 2018, leading to a decline in earnings. In commodity chemicals, we will ensure safe and stable operations at production sites and increase its stability as a foundation business.

On the other hand, to raise the entire company's earnings, we seek to increase the proportion of specialty chemicals such as MXDA, MX nylon, aromatic aldehyde, and heat-resistant transparent polyimide through the development of new technologies and products, and through marketing in close cooperation with customers. In particular, we will promote the development of applications for MXDA, which has outstanding performance, and work to raise productivity and expand production capacity.

Growth Initiatives

To optimize our business portfolio, we take a "product-out" approach and a "market-in" perspective.

Product-out is a product development method designed to gain a superior competitive position in new markets by using core technologies and the connection between existing products and the product being developed. In contrast, "market-in" seeks to create new technologies and products while working with the customer to determine the value they require and the issues they need to resolve.

To that end, we have set up a marketing team that includes members of the development division to facilitate proactive collaboration with both researchers and sales representatives. We will also improve technical support to gain an understanding of the functions and quality that customers truly want, and to help them properly use our products.

Focus

Heat-Resistant Transparent Polyimide Neopulim Facilitates Display Evolution

Neopulim is a high-performance material that is both highly transparent and heat-resistant. It has attracted attention as a resin film substrate that is an alternative to glass, especially for use in foldable OLED (organic light-emitting displays).

Flexible display panels are gaining momentum, even in the automotive field where the introduction of automated driving is advancing. Neopulim holds promise in the automobile industry due to its various properties including light weight, workability, chemical resistance, and low retardation.

Expansion of MXDA Production Capacity due to Growth in Demand as a Product and Raw Material

While MXDA has a certain market share as an epoxy resin curing agent and corrosion-proof paint, it is one of the company's core products that is also a raw material for derivatives such as MX nylon, whose gas barrier properties are attracting much interest. In response to growing worldwide demand for MXDA as a product and raw material, we are considering the possibility of expanding production capacity, including at new production facilities outside of Japan.

At the same time, to expand sales to China, where demand for water-based paint is growing as environmental regulations tighten, we are also working on further application development by sending researchers to propose new formulations for MXDA and its derivative products.

Specialty Chemicals Company

To further expand sales of high-value-added products, especially in advanced fields such as information-communications and mobility, we will focus on investments to strengthen our production system, including increased capacity and optimization, and drive profit growth for the Group.

Business and Major products

Inorganic Chemicals

- Hydrogen peroxide
- Persulfates
- Electronic chemicals (Chemicals for use in the electronics industry)
- Monomers for high refractive index plastic lenses

Engineering Plastics

- Iupilon (Polycarbonate), Polycarbonate sheet, Polycarbonate film
- Iupizeta (Special polycarbonate)
- Iupital (Polyacetal)
- Reny (Polyamide MXD6 molding compound)

Review of Fiscal 2017 and the Medium-term Management Plan

With the booming semiconductor and automobile markets, the Specialty Chemicals Company achieved significant growth in both revenue and earnings over the three-year period of the previous medium-term management plan, helping the company reach its target profit.

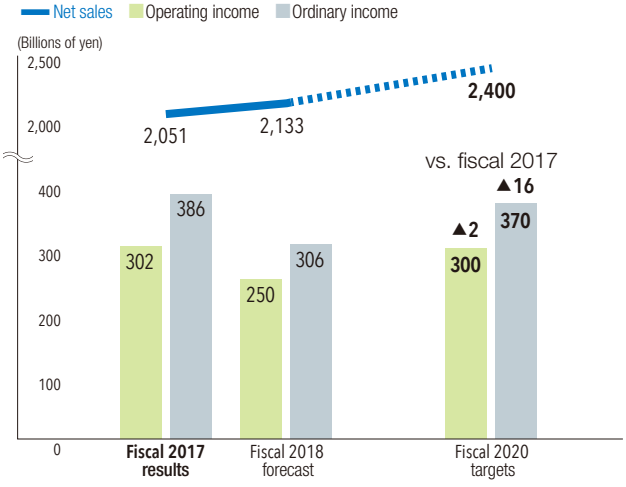
In the inorganic chemicals business, electronic chemicals (chemicals for use in the electronics industry) for semiconductors and LCD manufacturing drove growth. Strengthening relations with local customers led to increased sales and higher revenue and earnings, especially in the United States and bases in Asia.

In the engineering plastics business, revenue and earnings increased significantly due to continued strong demand, mainly in China, resulting in rising polycarbonate prices, as well as strong sales of special polycarbonate resins and sheets.

Susumu Yoshida

Director and Managing Executive Officer
President, Specialty Chemicals Company

Fiscal 2017 Results and Fiscal 2020 Quantitative Targets



Outlook

Demand for the company's products, both inorganic chemical products and engineering plastics, is robust. To maintain a strong competitive advantage, and further increase performance, we will focus on investments to reinforce production capacity starting in 2018.

In inorganic chemicals, we are building new super-pure hydrogen peroxide plants for cleaning semiconductor wafers for electronic devices at two locations, Oregon and Texas, in the United States. Both plants are scheduled to start operation in 2019 and, along with the existing Arizona Plant, will strengthen the supply system in the U.S. market.

For engineering plastics, the company is increasing manufacturing capacity for its super polycarbonate resin, lupizeta EP, which is experiencing sharply rising demand in the optical field for use in smartphone lenses and other applications. The plant is scheduled to begin operation in mid-2019.

In 2018, in addition to these investments, and with competition intensifying for electronic chemicals and the narrowing price spread for polycarbonate, we expect earnings to decline. Nevertheless, the production system, which will be significantly enhanced during the three years of the new medium-term management plan, will ensure the stronger presence of the Group in advanced markets such as information communications and mobility, and will serve as the basis for future growth.

Growth Initiatives

To increase performance, we must strongly promote localization outside of Japan and shift to advanced fields.

We are expanding business outside of Japan in both inorganic chemicals and engineering plastics, and will pursue localization not only through production, but also raw material procurement, R&D, technical support, and other functions. We will ensure stable sales over the medium to long term by forging closer relationships with local customers.

In our shift to advanced fields, we will address technological innovations in key markets such as information communications and mobility. In the semiconductor field, microminiaturization and higher precision are advancing further, and electronic chemicals are also required to offer greater functionality and better quality than before. The company will differentiate itself from its industry peers by exercising the unique technological capabilities it has developed to meet requirements for high quality, and will support the evolution of semiconductors together with their manufacturers.

In the automotive field, we will further raise our presence by responding quickly to technological trends such as the growing demand for on-board devices accompanying the shift to electric vehicles (EVs), the evolution of in-vehicle displays that support automated driving, and the replacement of metal with resin to reduce weight.

Focus

Strengthen Product Development in the Optical Field Centered on Special Polycarbonate

Materials for camera lenses installed in smartphones and tablets require a high refractive index, which contributes to thinner lenses, and a low birefringence, which contributes to image sharpness. Super polycarbonate resin, *lupizeta* EP, which makes all of this possible, has the world's highest market share. In 2017, the Specialty Chemicals Company received the chemical industry's first Ichimura Prize in Industry for Outstanding Achievement for the Development of Special Polycarbonate Resin. With the growing demand for optical components, including in-vehicle cameras and surveillance cameras, the company is focused on product development that will drive the growth of this field.

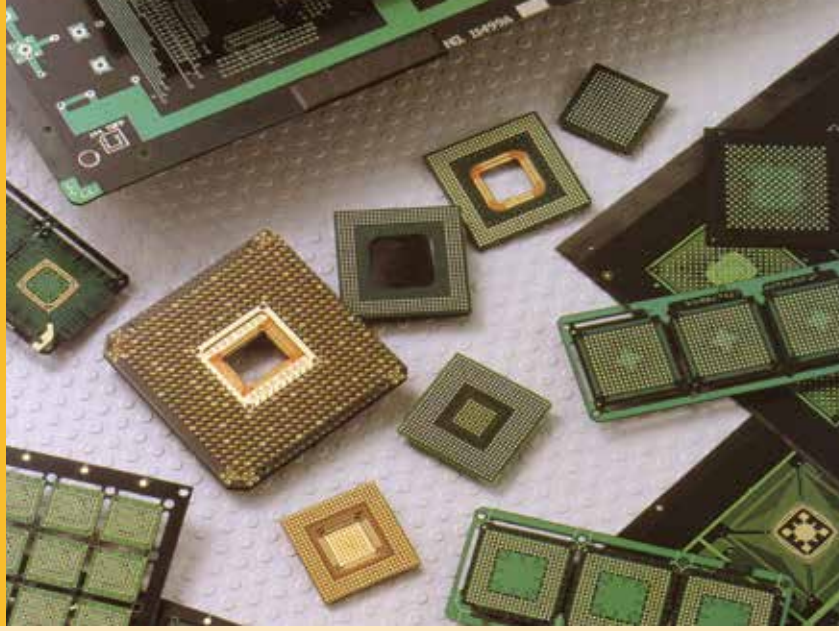
Pictures are images

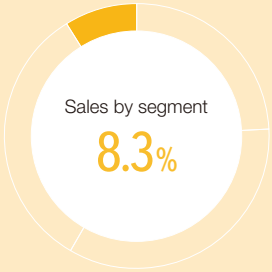
Promote Localization Outside Japan to Forge Closer Relationships with Customers

In the electronics industry, the target of electronic chemicals, the recent tightening of intellectual property controls has led to prohibitions against taking products or data overseas. Therefore, localization is required not only for manufacturing, but also for R&D, technical support and other functions. Under these circumstances, we have established a new R&D building at our Taiwan subsidiary to build closer relationships with customers outside Japan.

Information & Advanced Materials Company

We will implement a highly profitable business model by accelerating the research and development cycle and continuing to produce high-value-added technologies and products while anticipating the value needed by a changing society.





Business and Major products

Electronics Materials

- Laminate materials for printed circuit boards
- LE SHEET (auxiliary material for drilling)

Oxygen Absorbers

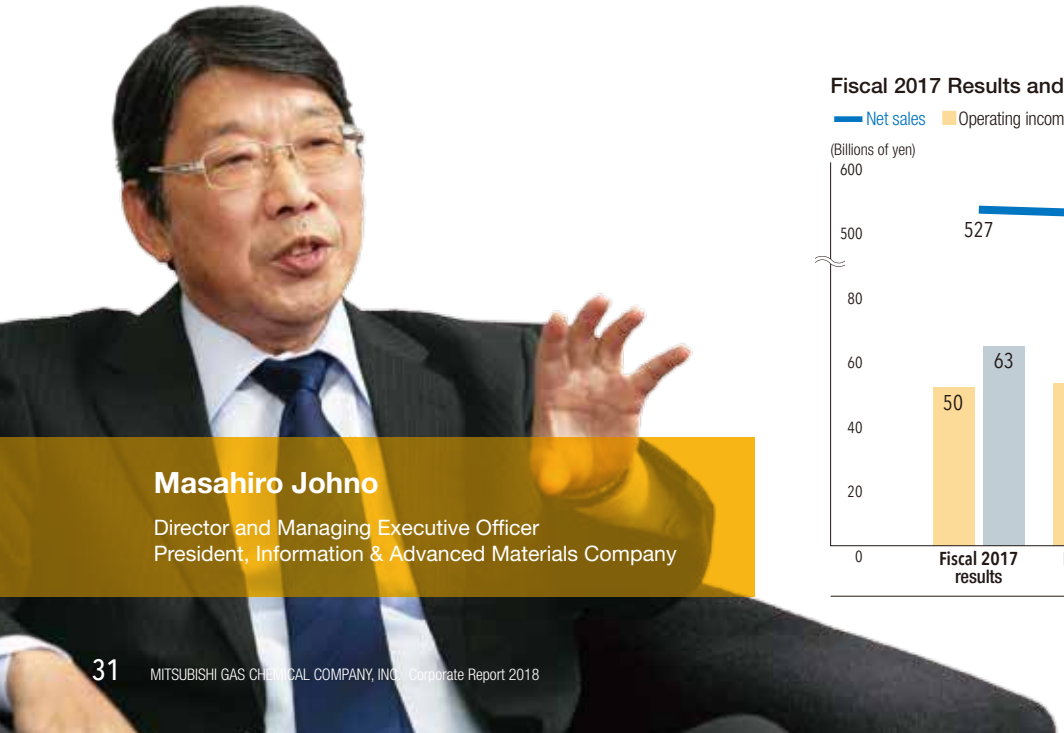
- AGELESS
- AGELESS OMAC (oxygen absorbing film)
- PharmaKeep (for pharmaceuticals and medical equipment)
- AGELESS DRY (desiccant)
- Anaero Pack (anaerobic cultivation system)
- RP System (for electronic and machinery components)

Review of Fiscal 2017 and the Medium-term Management Plan

In the electronic materials business, we focused on developing products for the high performance, higher-priced high-end market. As a result, we achieved yearly sales growth and increased revenue and earnings in fiscal 2017. Optimizing the business chain including Group companies and withdrawing from low-profit and low-growth businesses, as well as improving the company's earnings structure contributed to the earnings increase.

The oxygen absorber business has continued to increase revenue by expanding sales to the pharmaceutical and overseas markets, as well as its mainstay domestic food market.

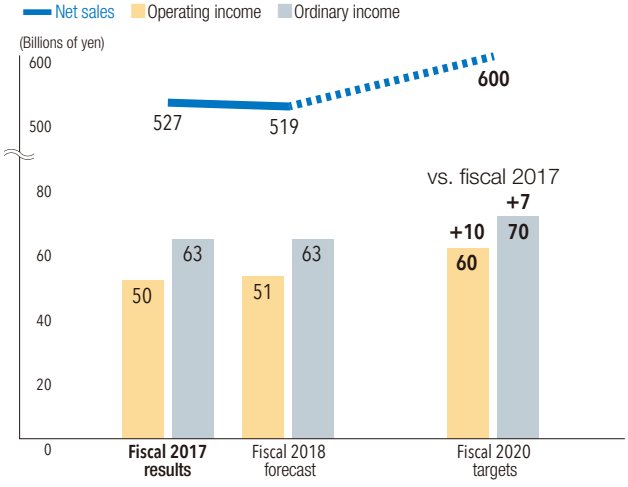
In fiscal 2017, although earnings declined due to the fixed cost burden of the new plant built in the QOL Innovation Center Shirakawa, the oxygen absorber business will be boosted by enhancing the production base in both Japan and Thailand.



Masahiro Johno

Director and Managing Executive Officer
President, Information & Advanced Materials Company

Fiscal 2017 Results and Fiscal 2020 Quantitative Targets



Outlook

The operating environment in the electronic materials business will continue to be brisk for the semiconductor market, especially memory chips. The spread of IoT, the computerization of automobiles, and other such trends are expanding demand for semiconductor devices across society as a whole, and at the same time, greater functionality is being required of those materials.

In materials that meet advanced requirements, we have already begun to produce results in leading-edge areas, such as fingerprint authentication and virtual currency data mining. Along with this sales expansion, we will speed up the development of next-generation products including collaboration with outside parties in areas such as open innovation and M&A.

In the oxygen absorber business, while seeking to increase our market share in the maturing domestic food market, we will continue to expand sales in overseas markets and develop new applications. We will also focus on providing solutions to higher value-added fields such as pharmaceuticals and the precision machinery industry.

Growth Initiatives

As a company that provides high-performance products that are widely used in the electronics and medical fields, the Information & Advanced Materials Company seeks to be a high-profit R&D-centered company. With the successive development of technological innovations that produce major changes in society, such as IoT, AI, self-driving vehicles, and next-generation communications systems, the constant creation of new products is a prerequisite for sustained growth.

For example, in the electronic materials, demand for substrate materials for data centers is rapidly expanding business. Meeting the need for heat-resistant materials that can accommodate an increase in the amount of heat generation proportional to the volume of information helps curb air conditioning energy and offers a solution to both customer and social issues.

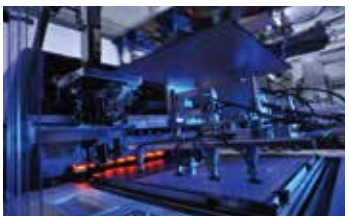
Even the oxygen absorber business triggers new demand both in and outside Japan by promoting advantages other than food safety and security, such as the impact of reducing food loss as a food resource countermeasure, and the effects of reducing the use of food additives to accommodate the health-conscious.

In this way, we will work to create new value and at the same time proactively take on new frontiers in collaboration with the Advanced Business Development Division.

Focus

Optimization of the Business Chain through Group Restructuring in the Electronic Materials Business

In December 2017, the Information & Advanced Materials Company reorganized its group subsidiaries to optimize the electronic materials business chain. Yonezawa Dia Electronics Co., Inc., which is responsible for manufacturing printed circuit boards and other items, was made a subsidiary of MGC Electrotechno Co., Ltd., which is responsible for the manufacture of copper clad laminates. We will expand sales by integrating both companies to raise effectiveness and efficiency. In addition, MGC Electrotechno Co., Ltd. will focus on the technology development functions of the Electronic Materials Division as a whole by effectively leveraging the technical resources of each group company, including production technology, quality assurance technology and technical service.



Creation of the Shirakawa Plant of MGC AGELESS Co., Ltd., a New Production Base for the Oxygen Absorber Business,

MGC opened the MGC Ageless Company Limited's Shirakawa Plant in its QOL Innovation Center Shirakawa and began operation in April 2017. In addition to the stable production of high-quality products, MGC will create a supply system that is able to quickly respond to the sophisticated needs of its customers.

New Businesses

Taking advantage of MGC's strengths, we will make proactive use of outside resources to rapidly establish new businesses that meet society's needs.

The Role of the Advanced Business Development Division

The Advanced Business Development Division was established in April 2015. Comprising the Business Strategy Group, Business Development Group, and Advanced Business Research Center, it seeks to rapidly create and develop businesses in new domains by integrating processes up to commercialization, from selecting the target business domain to performing the necessary technical R&D, as well as market development.

Given our responsibility for business development in new domains, it is essential that we not think "what can we do with our technology," but rather "what does society need," and based on that, determine the fields that take advantage of our strengths. To do that, we will bring a broad, flexible approach and market perspective to creating a concrete path to commercialization.

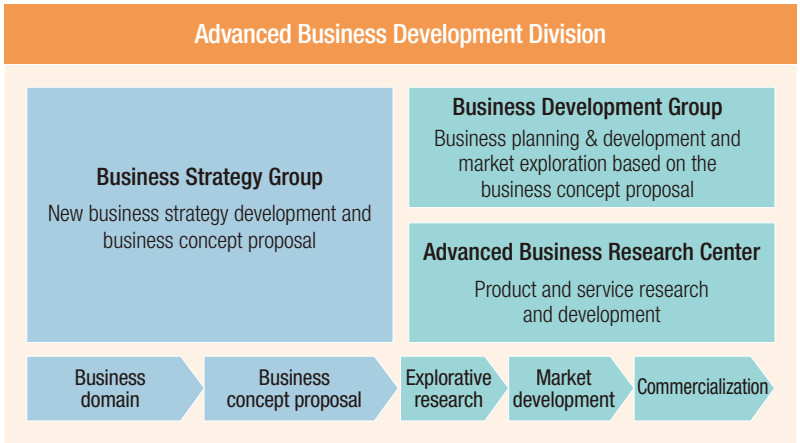
Policies for New Business Development

In addressing domains not currently part of the MGC Group, we must not rely solely on skills developed within the Group, but also introduce knowledge from outside. We will recruit experts with knowledge in various specialized fields, including medicine, pharmaceuticals, telecommunications and agriculture. We will also collaborate through open innovation, invest in venture companies, and actively cooperate with outside firms and research institutions, all with an eye to potential mergers and acquisitions.

Whatever the project, manufacturing requires materials, and by taking advantage of the Group's diverse materials, we will work toward early commercialization while maximizing synergies.

Yoshihiro Kayano

Executive Officer
General Manager, Advanced Business Development Division
Deputy General Manager, Business Strategy Division



Vision and Philosophy for Creating New Business

When creating a new business, it is important to develop a story that offers a concrete vision for a future beyond initial success, one that describes where and how the technology, products, and businesses that we create will be used in society and what kind of value they will generate. Even in collaborating with outside partners, communicating such a story will allow us to quickly and clearly share a sense of purpose and create a reliable partnership.

Target Domains for New Business

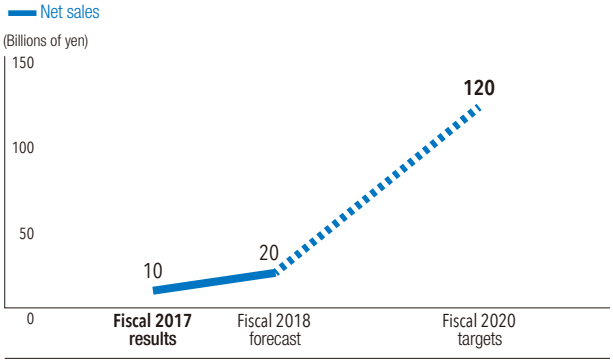
The Advanced Business Development Division targets the five business domains of medical/food, information/communications, mobility, energy, and infrastructure. We are placing particular focus on the medical/food field.

The table at upper right presents areas where a certain level of sales are already anticipated; the sales targets set for new businesses in the medium-term management plan are also based on these figures.

Target Domains for New Business

Medical / food	Mobility	Information / communications	Infrastructure / Energy
Plastic vials and syringes OXYCAPT	All-solid-state lithium-ion batteries Complex hydride solid electrolyte		
Nucleic acid pharmaceuticals			
Factory farming business		Active optical cable	

Sales Plan for New Businesses and Products



Focus

Entering the Factory Farming Business by Leveraging Knowledge of Chemistry

The vegetable factory is a cultivation facility capable of continuous and systematic production through the artificial control of environmental conditions such as light, temperature and humidity, carbon dioxide levels, moisture, and nutrients required for the growth of plants in the facility. MGC has built a large-scale vegetable factory with 100% artificial lighting using LED as its light source. The factory produces safe, reliable leafy vegetables in an optimal growth environment free from climatic influences, with the goal of providing a stable supply. In the factory-based vegetable production business, we seek to build a sustainable agricultural model by using MGC's wide-ranging knowledge of chemistry in the pursuit of a more efficient cultivation environment, and to provide safer, more reliable vegetables.

OXYCAPT Plastic Vials and Syringes

MGC has developed OXYCAPT, the world's only multilayered plastic container that is highly resistant to cracking while offering high oxygen barrier properties similar to those of glass. In addition to low extractables of inorganic substances and the light weight, it also has superior UV barrier properties, thereby enabling the long-term storage of pharmaceuticals. The stability and effectiveness of this product can also be enhanced during its effective period of use.

These features have also been evaluated by pharmaceutical companies that handle bio-pharmaceuticals and emergency medicines such as epinephrine and dopamine.

Research and Development

MGC has helped build a prosperous society and achieved sustainable growth, quickly giving shape to the value society seeks by maximizing technological synergies in and outside the Group.

R&D Policy

Of the five measures listed MGC Advance2020, the medium-term business plan, “Strengthening the earning power of existing businesses with a focus on the core businesses” and “Creating and developing new businesses” in particular are closely connected to R&D.

We will conduct research and development in existing businesses that will help improve quality and enhance our cost-competitiveness, so that we can continue to support earnings as part of the backbone of the MGC Group.

At the same time, in the new businesses, it is required to quickly find research themes that match social trends. For example, one recent result of our development work was a special polycarbonate that is used as a lens material for cameras in smartphones and other devices; it succeeded because it was developed at a time when smartphones were coming into widespread use.

If we can quickly determine the kind of value society needs next and achieve that value in a timely manner, we can take the lead in fields with strong future prospects. This is the kind of R&D we will pursue in helping to create and develop promising new businesses.

Promoting Research and Development

The third measure noted in the medium-term management plan is “Improving Group-wide operational efficiency.” To take full advantage of the Group’s technology and expertise, we are deepening collaboration between companies and Group companies in an effort to create synergies.

We emphasize sharing information and work on holding discussion with each other, such as holding a poster presentation that presents research results and discussing ideas by utilizing the internal network. In addition, since it is important to receive objective third-party assessments, we also give presentations at academic conferences, match businesses with venture companies, and promote exchanges with corporate customers.

R&D Investment

To enhance the quality that supports sustainable growth, we focus on hiring and training R&D personnel and improving the research environment.

MGC also provides opportunities to not only gain cutting-edge knowledge aligned with specific research themes, but to learn skills that focus on the commercialization process, such as marketing and intellectual property.

We also create an environment that encourages dynamic, more efficient R&D, for example, by creating search sites where users can conduct document searches as well as market research, and by introducing research support tools.

Masamichi Mizukami

Director and Managing Executive Officer
In charge of Research & Development Division,
Advanced Business Development Division

R&D goals and targets

Enhancing the profitability of existing businesses
- Emphasizing R&D themes leading to greater profitability
- Continuously improving core technologies

Creating and developing new businesses
- Achieving profitability in new businesses early on
- Acquiring technologies with an eye toward the future business portfolio

Improving group-wide operational efficiency
- Strengthening ties with group companies

Improving total enterprise quality to support of sustainable growth
- Hiring and developing human resources
- Providing an enhanced research environment

R&D strategy

Technology platform and main products

Catalyst	Synthesis	Polymerization	Functional products	Life science
Superacid / Solid catalyst / High pressure	Air oxidization / Liquid-phase oxidization / Hydrogenation	Condensation polymerization / Bulk polymerization / Oxidization polymerization / Film and sheets / Resin treatment	Oxygen absorber-related / Varnish-related / EL chemical-related	Continuous cultivation / Breeding / Antibody drugs technology

Research and Development Organization

Company R&D

	R&D Department
Natural Gas Chemicals Company	Niigata Research Laboratory
	R&D Department of Niigata Plant
Aromatic Chemicals Company	Hiratsuka Research Laboratory
	R&D Department of Mizushima Plant
Specialty Chemicals Company	Tokyo Research Laboratory
	R&D Department of Yokkaichi Plant
	R&D Department of Yamakita Plant
	R&D Department of Kashima Plant
Information & Advanced Materials Company	Research and Development Center

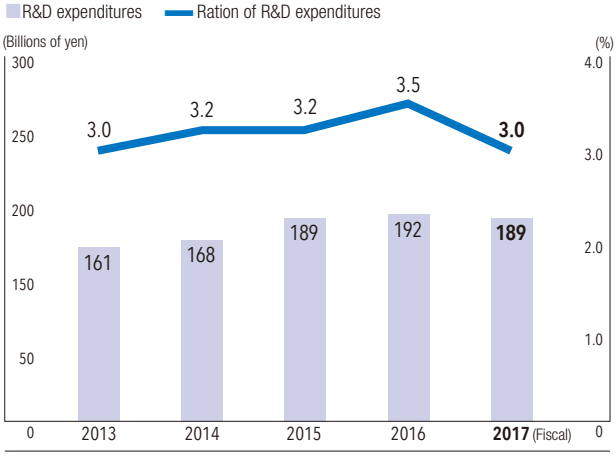
Corporate R&D

Advanced Business Development Division	Advanced Business Research Center
Research and Development Division	R&D Administration Department
	Intellectual Property Department
	MGC Chemical Analysis Center

The primary purpose of company research is to make businesses with a competitive advantage stronger and to develop new products that are based on existing products and technologies. This work is mainly carried out in each company's research and development division.

Corporate R&D works with the Advanced Business Development Division on R&D to create new core businesses in promising fields from a long-term perspective.

Results of R&D expenditures (consolidated)



Intellectual Property and Patents

Intellectual property plays an important role as a source of corporate competitiveness. At MGC, the Research and Development Division, the Business Division, and the Intellectual Property Group work together as one to formulate and pursue strategies for the effective use of intellectual property. Specifically, these divisions perform rigorous "technology clearance searches" to check for third-party infringement on patent rights and "prior art searches" to check whether research results can be patented. In addition, MGC aggressively protects and acquires the rights to the achievements produced by all core and new businesses.