

Overview of Business Segments | Industrial Materials Domain

# Industrial Materials

## Industrial Materials Domain

MCHC will continue to advance the diversification of raw materials, including renewable resources, provide products and technologies through a framework that reflects the needs of the time, and support growing markets.

### Major Businesses and Products

**MMA** Fiscal 2016 Revenue **¥285.9 billion**



#### MMA

We are the only company that employs all three main manufacturing methods\* and maintains a leading 40% share of the global market. With a globally established supply system that takes advantage of raw material availability for individual plants and cost competitiveness, we aim to realize the most advanced and sophisticated operations.

\* Acetone cyanohydrin (ACH) method, C4 direct oxidation process, and new ethylene process (Alpha Technology)

#### PMMA

PMMA (acrylic resin) has various excellent characteristics such as superior transparency, strong weatherability and formability. We operate business with a variety of PMMA products including acrylic sheets for signs, display shelves and aquarium tanks, molding materials for automotive products, optical components and home electronic parts, and plastic optical fibers.

MMA, PMMA

**Petrochemicals** Fiscal 2016 Revenue **¥500.3 billion**



#### Basic petrochemicals and basic chemical derivatives

Our ethylene plants are located in Kashima and Mizushima\* in Japan. We provide olefins such as ethylene and propylene, and aromatics such as benzene and toluene. We also deal in various ethylene, propylene and C4 derivatives, terephthalic acid, and more.

\* The Mizushima ethylene plant is owned by Asahi Kasei Mitsubishi Chemical Ethylene, which is jointly owned by Asahi Kasei and Mitsubishi Chemical.

#### Polyolefins

Our polyolefin (polyethylene and polypropylene) business offers high quality and high performance product lineups in a wide range of fields including automobiles, electrical wires, medical devices and food packaging based on proprietary catalyst and process technologies. We are also expanding its business outside Japan as a global supplier of high performance materials while developing the growing global markets including the automobile industry.

Basic petrochemicals, Basic chemical derivatives, Polyolefins

SWOT Analysis

**S** Strengths

Petrochemicals

Conducted structural reform of naphtha cracker. Now utility reinforcement and promotion of high-value-added products are in progress

MMA

Possesses three major manufacturing methods. Holds a strong market position with the world's top market share

Industrial Gases

Holds a strong market position with the domestic top market share

Carbon Products

Coking coal blending technologies and Coke quality management technologies

**W** Weaknesses

Petrochemicals

Susceptible to price fluctuation impacts of commodities such as crude oil

MMA

Fluctuating revenue due to overseas market conditions and raw material trends

Industrial Gases

Relatively expensive domestic cost structure (electricity rates)

Carbon Products

Fluctuating revenue due to volatile coking coal prices

**O** Opportunities

Petrochemicals

Knowledge business (technology license, catalysts) in overseas growth regions

MMA

Business network positioned to respond to global expansion of demand

Industrial Gases

Greater opportunity to invest in North America, Asia and Oceania. Expanding demand for electronics and medical uses

Carbon Products

Expanding production of crude steel and demands for coke in developing countries such as India

**T** Threats

Petrochemicals

U.S. shale-based products and Chinese coal-based products flowing into the Japanese market in greater quantities than expected

MMA

Competition with other materials

Industrial Gases

Oligopolization in overseas markets by major European and North American gas producers

Carbon Products

Integration of blast furnace along with the restructuring of steel companies



Carbon Products Fiscal 2016 Revenue **¥197.9** billion



Coke

Coke supports the global steel industries, and various products are also produced from the tar created by the coke manufacturing process. Each year we import coals from countries around the world and produce coke of different qualities by blending around 60-70 types of raw materials in various combinations.

Carbon black

Carbon black is a material used for products found in daily life, such as tires, printing ink, and colored resins. We manufacture carbon black under consistent quality control throughout the process beginning from raw material processing to the final products.

Coke, Carbon material, Carbon black, Synthetic rubber

Industrial Gases Fiscal 2016 Revenue **¥574.6** billion



Industrial gases

We have a leading 40% share of the domestic market for industrial gases, mainly oxygen, nitrogen and argon. We are expanding our business areas overseas while focusing on North America, Asia and Oceania as key markets.

Industrial gas-related equipment and facilities

Besides our domestic production of Japan's first air separation plant, we have earned a stellar reputation as a world's top-class plant manufacturer through the production of space-simulation chambers and liquid helium-related equipment.

Industrial Gases, Industrial Gas-related equipment and facilities

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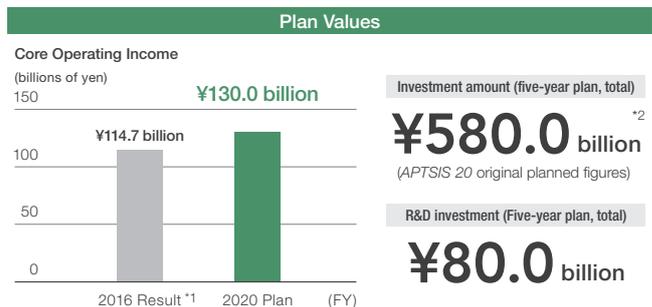
**Industrial Materials Domain APTSIS 20**

Policies

Stabilization of earnings by strengthening of cost-competitiveness  
 Acceleration of growth and strengthening of presence in the global market

Key Strategies

- Strengthening of cost-competitiveness
- Acceleration of global development (MMA, industrial gases)
- Business rebuilding

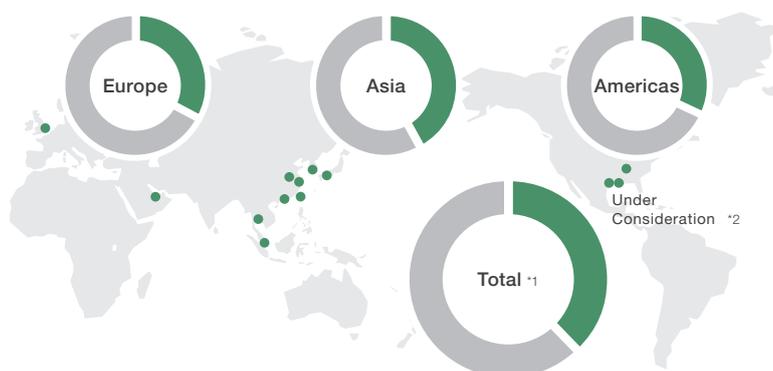


\*1 Since fiscal 2017. Changes have been made to some segments. Fiscal 2016 results have been replaced with figures after the segment changes.  
 \*2 In December 2016, MCHC announced that it would increase investments and loans by between 100 and 200 billion yen on a company-wide basis.

**Growth Strategies of MMA**

To maintain its competitive advantage as the world's leading supplier of MMA monomers with a market share of around 40%, we will seek to boost production capacity and optimize its production system. We have established a joint venture with SABIC(Saudi Basic Industries Corporation) in Saudi Arabia. Under this joint venture, a plant with the world's largest production capacity based on the competitive New Ethylene Method (Alpha Technology) using natural gas-based raw materials, will start its operation in the middle of 2017. Construction of another plant that would use shale gas-based raw materials is being considered for North America. We will continue to optimize its production systems based on the supply and demand environment so as to ensure stable revenue.

**MMA Production Sites and Market Share by Region**



\*1 Market share prior to launch of SAMAC (The Saudi Methacrylates Company) project  
 \*2 Consideration of shale gas-based North American project

**Strategic Approach to Strengthening Competitiveness of Petrochemicals**

Up to 2016, we pursued the consolidation of its domestic ethylene centers and the equity interest transfer of its terephthalic acid businesses in India and China. We had specific aims in these structural reforms, preparing ahead of its competitors for the so-called "arrival of black ships" in which competitive products using North American shale gas as raw materials entered the Asian markets. Looking ahead, we will continue to strengthen competitiveness by further reinforcing the foundations of its production sites and optimizing production while seeking to maximize earnings through improved added value targeting the unutilized fraction between cracker and derivatives, the development of high-performance polyethylene and polypropylene, and the expansion of technology licenses through a refinement of possessed technologies.

	APTSIS 10	APTSIS 15	APTSIS 20	After APTSIS 20
<b>Basic Petrochemicals</b>	Fuel Conversion	Cracker structural reforms ● Unification of Naphtha crackers at Kashima ● Unification of naphtha crackers at Mizushima Improving the value of all unutilized fraction	Preparations for a raw material revolution Refinery alliances Preparation for raw material diversification	
<b>Polyolefin</b>		Production optimization (Reorganization of production lines) ● PE/PP: Optimization of production system	Complex alliances Utility Alliances (Wide-area, Other Companies)	
<b>Basic Chemicals</b>	Withdrawal from unprofitable derivatives	● Setting up EO center Increased EC production capacity ● Restructuring of caustic soda and VCM	● Downsizing of TPA business ● Withdrawal from PTMG business (China)	Enhancing derivatives business (chain) Coordination with other business divisions
<b>Common issues</b>			Strengthening plants	Development of high-value-added products, technology licensing

●...Measures including establishment of new facilities    ●...Restructuring, downsizing and suspension

# FOCUS

## Growth Strategy

### Expansion of overseas business areas for industrial gases business and sustainable growth of domestic businesses

Taiyo Nippon Sanso Corporation (“TNSC”) has a leading 40% share of the industrial gas market in Japan. Having expanded its business areas with focus on North America, Asia and Oceania as key markets, the company has developed operations in 19 countries and regions around the world to date.

While the domestic industrial gas market has been experiencing the medium-range low growth, in regions such as North America, Asia and Oceania, further growth is expected in the future, and further oligopolization by major industrial gas producers in Europe and North America has been taking place. To compete with those major industrial gas producers in Europe and North America, we will pursue sustained growth domestically and seek to expand our overseas operations.

Specifically, “structural reform,” “innovation,” “globalization” and “M&A” will form the pillars of our strategy. By maximizing Group synergy through the expansion and structural reforms of gas and gas-related businesses domestically, we will further

reinforce our industry-leading position. And overseas, we will aggressively promote capital investment and M&A activities in an effort to expand our business areas.

In fiscal 2016, TNSC acquired the U.S. industrial gas business and assets of Air Liquide S.A., the biggest such acquisition in its history. The acquisition meant that in addition to its existing operations primarily in the southern and Midwestern U.S., TNSC acquired a business network in the Eastern U.S. and a more robust operating network in the Midwest. Moreover, with the acquisition of Supagas Holdings Pty Ltd in Australia, TNSC completed a sales network spanning the entire country.

TNSC plans to invest further ¥340 billion from fiscal 2017 to fiscal 2020, 70% of which it plans to allocate toward strategic investments. TNSC will endeavor to fully utilize these investments to further expand its business areas primarily overseas and achieve sustained growth in its domestic business.

#### Promotion of M&A strategy



#### Solutions for Environmental and Social Issues

##### Established production facilities for liquefied carbon dioxide at Mizushima plant of Nippon Ekitan Corporation

TNSC’s group company Nippon Ekitan Corporation handles liquefied carbon dioxide. Roughly 50% of carbon dioxide gas is used in iron welding as a shielding gas. It is also used in various other applications such as beverages, and the freezing or chilling of foods.

In recent years, due to the decreasing demand for fuel oil and the closure of domestic ammonia production facilities, the production of high-concentration carbon dioxide gas as a raw material has declined significantly, which caused tight supply-demand balance of finished products. Particularly, productions in the Chugoku and Shikoku regions have declined drastically, resulting in constant long-distance transport from other regions. Production of high-concentration carbon dioxide gas as a raw material from this business category is expected to decline further in the future.

Nippon Ekitan plans to establish liquefied carbon dioxide production facilities at the Mizushima plant in October 2017. The facilities will be able to collect the low-concentration carbon dioxide generated from the MCC Mizushima site on the same premises and effectively utilize it as high-quality liquefied carbon dioxide. As the production process involves effectively utilizing carbon dioxide gas that would otherwise have been released into the atmosphere instead of generating new carbon dioxide, the facilities significantly contribute to reducing environmental load, and also help to reduce long-distance transportation by ensuring a more stable supply to users in the Chugoku, Shikoku and Kansai areas.