

Business Overview of the Mitsubishi Chemical Group Focus on the Electronics and Healthcare & Life Science Market That Draw Global Attention Through the Use of Technologies From Japan's Largest Chemical Manufacturer.

- Contributing to the solutions of future issues including carbon neutrality -

The Mitsubishi Chemical Group (MCG), as the largest chemical manufacturer in Japan, formulated the new management policy, "Forging the future," for the period ending FY2025. This newsletter will introduce our management policy and specific products. Going forward, MCG will put special effort into the Electronics and Healthcare & Life Science markets, which are drawing global attention. In these markets, MCG will contribute to the solutions of global challenges for the future, such as carbon neutrality, by providing materials produced by the technologies of the largest chemical manufacturer in Japan.

Contents 1. Highest Priority Markets for MCG



MCG selects its priority businesses based on three criteria: (1) Market attractiveness; (2) Strengths of the Group; and (3) Carbon neutrality.

Based on the above three criteria, MCG positions the two markets of "Electronics" and "Healthcare & Life Science" as its highest priority strategic markets.

Contents 2. Electronics Market: Products for Creating a Future Society



As for the electronics market, our target domains are "EV" and "digital," using the core technologies of MCG. Within these domains, we will endeavor to strengthen products centering on (1) GaN substrate; (2) Carbon fiber; (3) Plant-derived engineering plastic; and (4) Anode materials and electrolyte solutions. These products will also be associated with social infrastructure in the future.

contents 3. Healthcare & Life Science Market: Products for Our Daily Life



In the Healthcare & Life Science market, we will lead innovation for sustainable food supplies and achieve late-stage projects for vaccines and other drugs.

(1) High gas-barrier resins; (2) Highly functional films; (3) Sugar esters (emulsifiers); and (4) Pharmaceuticals and vaccine products directly link to the major challenges of modern society such as food waste and COVID-19, which are drawing attention.

*Pictures used in this material include those for illustration purposes only.

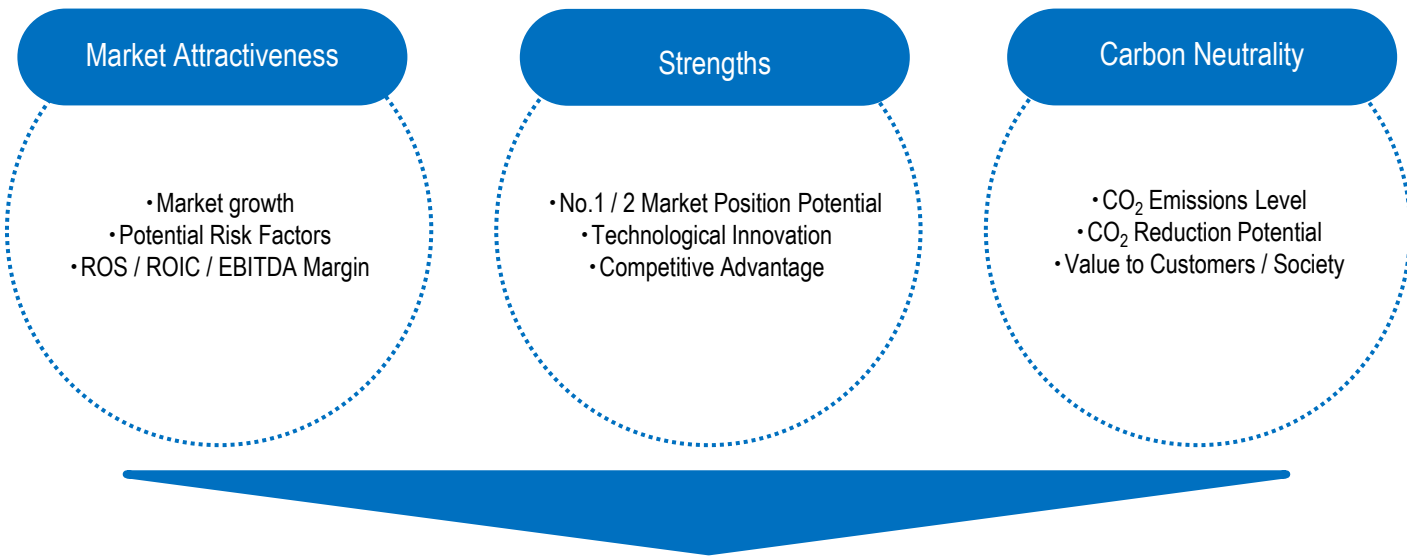
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Contents 1. Highest Priority Markets for MCG

MCG's new management policy, "Forging the future," focuses on market growth potential, competitiveness and sustainability. We select priority businesses based on these criteria. We endeavor to maximize corporate value by managing the portfolio in the growth markets where MCG has a competitive advantage.

【Our Portfolio Assessment Criteria】



【Our Strategic Focus】

Carbon Neutrality

Strengths

Focus Markets



Electronics



EV

- Lightweight materials for mobility
- EV battery materials
- Wide bandgap semiconductors



Digital

- Semiconductor materials
- Materials for high-speed communication



Healthcare & Life Science



Food

- Specialty food ingredients
- Nutrition
- Materials for long-term storage



Healthcare

- Vaccines
- Central Nervous System diseases
- Autoimmune diseases

With carbon neutrality placed at the base and considering the growth potential of markets and profitability, we have positioned the two markets of "Electronics" and "Healthcare and Life Science" as the highest priority strategic markets, in which MCG can also take advantage of its strengths and products.

Contents 2. Electronics Market: Products for Creating a Future Society

Our target domains in the electronics market are “EVs” and “Digital.” Although they are not directly visible in our daily life, the products in these domains will change at an accelerated pace, relating to environmental issues and social infrastructure, supporting our future life.



Electronics



EV

- Lightweight materials for mobility
- EV battery materials
- Wide bandgap semiconductors



Digital

- Semiconductor materials
- Materials for high-speed communication

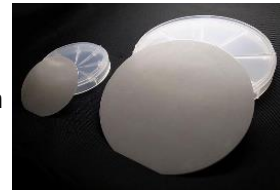
In conjunction with the carbon neutrality movement worldwide, the Japanese government set the goal of electric vehicle (EV) sales reaching 100% of new passenger car sales by 2035. The evolution of automotive materials and lithium ion batteries for EVs is accelerating. Furthermore, in the “Grand Design and Action Plan for a New Form of Capitalism,” which was approved at the Cabinet meeting in June 2022, the strengthening of “Semiconductors with leading power-saving performance” was clarified as the “Foundation of digitalization and carbon neutrality.”

(1) GaN Substrate: Unsung hero for a future society



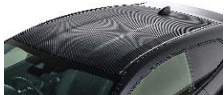
“GaN” is a crystal structure compound of nitrogen and the metal gallium, and is used as a material for semiconductors. Its properties enable the realization of power semiconductors that can make possible high-speed movement with lower resistance and reduced power loss. Furthermore, since it is capable of performing large-capacity power conversion, more efficient power conversion can be realized while controlling exhaust heat by applying it to a power converter. It is expected that the GaN substrate will contribute to non-contact charging of EVs, in-wheel motors, extension of travelable distance, improved efficiency in power generation using renewable energy, etc. It is also expected that effective application to “5G” next-generation high-speed communication and post “5G” communication systems, such as high-frequency and optical communication devices capable of instantaneously transmitting and receiving large capacity data, will become possible because the material can move electrons at a higher speed than silicon-based substrates.

Previously, manufacturing high-quality GaN substrates was challenging, and it was said that mass production is difficult when considering manufacturing costs and other factors. However, jointly with The Japan Steel Works, Ltd., MCG completed one of the world’s largest GaN substrate manufacturing facilities, where we conduct demonstration experiments for the mass production of GaN substrates using new manufacturing technologies. Based on these demonstration experiments, we will endeavor to establish a stable supply system of GaN substrates and develop 6-inch substrates applicable to power devices for which demand has been increasing in recent years.



GaN substrates

(2) Carbon Fiber: Body weight reduction for EVs



“GR Yaris” to which SMC is applied.
(Photo provided by Toyota Motor Corporation)

Sheet molding compound (SMC) is a type of intermediate base material in carbon fiber reinforced plastic (CFRP), which is a sheet-formed plastic material in which carbon fibers cut centimeters-long are mixed. Since the weight of carbon fiber SMC is approximately one-third that of steel, the weight of a car body can be reduced, contributing significantly to the reduction of CO₂ emissions. This material is drawing much attention, as CFRP is also applied to aircraft bodies.

(3) Plant-derived Engineering Plastic: Reducing car body weight and CO₂ emissions in the production process using plant-derived plastics



DURABIO™ is an engineering plastic derived mainly from the renewable plant-based material, isosorbide. It is applied to automotive interior and exterior design parts due to its excellent impact-, heat- and scratch-resistance properties in addition to its light weight and outstanding property of transparency and weather-resistant discoloration. Compared to conventional engineering plastics, CO₂ emissions can be reduced at the production stage. With excellent color development, a smooth surface and deep hue can be expressed simply by adding pigments, and therefore, the painting step can be omitted. Furthermore, it is possible to significantly reduce the generation of CO₂ and VOCs (Volatile Organic Compounds) generated in painting and coating processes.



Upper left: DURABIO™
Upper right: Interior parts of the Mazda CX-8 (Photo provided by Mazda Motor Corporation)
Down: Front grille of the Mazda CX-5 (Photo provided by Mazda Motor Corporation)

(4) Anode Material and Electrolytes: Materials for lithium ion batteries—the essence of EVs



MCG’s natural graphite-based anode materials (MPG) are characterized by the fact that the volume of CO₂ generated in the production stage is 60% less than that of artificial graphite-based materials (ICG). With a high capacity, MPG shows excellent performance under rapid charging and discharging cycles, with remarkable low-temperature properties. For use in automobiles, MCG’s market share is among the largest. They are manufactured in Japan and China, and MCG plans to reinforce production capacity in China. Furthermore, manufacture and sales in Europe and the United States are also under consideration.

The formulated electrolyte significantly contributes toward improving battery performance by employing MCG’s proprietary functional additives in the formulation. For use in automobiles, MCG’s market share is among the largest, and the electrolyte is manufactured in Japan, China, the United States and the United Kingdom. Responding to the increased demand for EVs, MCG plans to enhance production capacity at each manufacturing base.


 High-performance electrolyte
and anode material

Contents 3. Healthcare & Life Science Market: Products for Our Daily Life

In terms of the Healthcare & Life Science markets, “Food” and “Healthcare” are our target domains. We focus on products closely related to our lives, such as environmental conservation, solutions to food waste problems and countermeasures against viruses that could threaten humanity.

Healthcare & Life Science



Food

- Specialty food ingredients
- Nutrition
- Materials for long-term storage



Healthcare

- Vaccines
- Central Nervous System diseases
- Autoimmune diseases

(1) High Gas-Barrier Resin: Contributing to reducing food waste by cutting off oxygen and extending the preservation life of processed foods



SoarnoL™, a food packaging material with high gas-barrier function, is ideal for vacuum packaging and packaging to fill nitrogen and carbonic acid, etc. Due to its function of cutting off oxygen that leads to quality degradation, SoarnoL™ is also applied to mayonnaise containers, etc. It is also widely used in containers for steamed chicken and jelly sweets sold at convenience stores, and rice-packed retort containers and many other familiar products. It contributes to the reduction not only of food waste but also the volume of plastics used. Responding to the increased demand worldwide amid heightened needs for environment-friendly products, we also plan to enhance production capacity in the U.K.



Products using SoarnoL™

(2) Highly Functional Films: Keeping in good taste by using highly functional films that are also applied to pharmaceuticals



DIAMIRON™, a highly functional film packaging material, is a multi-layered plastic created by MCG's proprietary technology that features oxygen barrier properties and resistance to pinholes and many other functions, and is also highly transparent. In addition to its application to food packaging such as vacuum packaging, it is also used for pharmaceutical and medical packaging such as transfusion bags and liquid medicine bags.

Goods packaged using DIAMIRON™



The production of food generates green house gasses (GHG) throughout the entire process, from material processing to disposal of waste food as garbage. Among others, the most familiar problem for consumers within the major food system is “food waste.” Incineration of food waste leads to GHG emissions, which is said to account for 8% to 10% of global GHG emissions.

This highly functional food packaging material that can realize extension of food preservation life contributes not only to limiting the volume of food waste but also to carbon neutrality by reducing GHG emissions generated from food disposal. Food packaged using materials capable of maintaining good taste supports new lifestyles in terms of having the most suitable emergency stocks in times of a disaster and decreasing the frequency of needing to go out shopping during the COVID-19 pandemic.

(3) Sugar Ester: Food emulsifier expands from Japan to the world



RYOTO™ Sugar Ester (sucrose fatty acid ester) is a food emulsifier produced from sucrose (sugar) and fatty acids derived from vegetable oil, which has been approved for use as a food additive for more than 40 years. It is used in a wide variety of foods such as canned coffee and whipped cream as well as industrial products, etc. MCG is proud to account for the largest market share of sucrose fatty acid ester in the world. To meet demand mainly from China and Southeast Asia, MCG plans to enhance production capacity, with a new plant to start operating in the summer of 2023.

(4) Pharmaceuticals and Vaccines: Creating hope for all facing illness.



Mitsubishi Tanabe Pharma Corporation, a member of MCG, has a history of more than 340 years if including the founding of its former company, Tanabe Seiyaku Co., Ltd., and is the second oldest company in the world and one of the oldest in Japan. It is mainly engaged in the research and development of “ethical drugs” prescribed by hospital-based doctors. Currently, we have been engaging in developing a combination vaccine for five diseases in collaboration with The Research Foundation for Microbial Diseases of Osaka University in response to social challenges. One of the group companies, Medicago Inc., is dedicated to developing vaccines using plants. We also provide RADICAVA, a drug used to treat amyotrophic lateral sclerosis (ALS). In May 2022, its oral suspension, “RADICAVA ORS,” was approved in the United States, and was launched in June. The provision of an oral suspension in addition to “RADICAVA” for intravenous infusion contributes to burden reduction for patients with ALS. In addition to these developments, the company develops therapeutic agents for erythropoietic protoporphyria, Parkinson's disease, etc., striving to provide new therapeutic options to patients facing incurable diseases.



Working on the production of vaccines using plants.