Towards a 2050 in which everyone can live comfortably

Everyday things such as automobile materials, foods, and plastics are evolving!

For a sustainable world

At Mitsubishi Chemical Holdings Corporation, our vision is to realize “KAITEKI,” which represents “the sustainable well-being of people, society and our planet Earth.” Rather than just solving environmental and social issues, we are aiming for the sustainable development of our society and the earth. In line with the trend of active involvement in SDGs worldwide, we will launch Mitsubishi Chemical Holdings KAITEKI Newsletter that conveys the characteristics of our businesses.

In October 2020, Japan’s Prime Minister Yoshihide Suga declared that the government aims to achieve carbon neutrality by 2050 as a response to climate change. The “Green Growth Strategy Through Achieving Carbon Neutrality in 2050” was formulated by the leading efforts of the Ministry of Economy, Trade and Industry in collaboration with related ministries and agencies. Its target is for Japan to bring down the overall emissions of greenhouse gasses, including carbon dioxide, to zero by 2050. The strategy was reported at the sixth meeting of the Growth Strategy Committee on December 25, 2020 .

In response to such trends, the first newsletter will introduce the businesses of Mitsubishi Chemical (“MCC”), an operating company of the MCHC Group, in the fields of “automobile/battery industries,” “food/agriculture/forestry/fisheries” and “resource circulation-related industries” of the action plan listed in the Green Growth Strategy. In 2050, a one-year-old child today will be 30 years of age. We will tell you what kind of efforts are underway and what kind of changes are occurring in our current lives as we seek a future where everyone can live comfortably. (Hereinafter, greenhouse gases are referred to as “GHG.”)

【Reference】 Our goals for GHG reduction by FY2030

We are aiming to reduce emissions in line with government target levels in each country and region.

Government’s target value for GHG emission reduction in domestic industry by FY2030	26% reduction (Comparison with FY2013)
Target value of GHG emission reduction of our entire business by FY2030	26% reduction 9.25 million t-CO_2-eq (Comparison with FY2013)

Article 1. Evolution of automobile materials: Automobiles are becoming lighter every year

“Promotion of vehicle electrification” is indispensable for achieving carbon neutrality. And vehicle electrification requires the reduction of vehicle body weight and higher quality lithium-ion batteries.
Here we introduce the materials that MCC is working on that will become the materials for the vehicles of the future.

Article 2. Development of bio-plastic: Plants to be used for applications such as the interior and exterior of vehicles and coffee capsules

(Photo courtesy of Suzuki Motor Corporation)

As a measure against climate change due to increasing GHGs, we can adopt alternative material, including bioplastics derived from plants such as sugar cane and corn. We will introduce the materials that MCC is developing to protect the earth.

Article 3. Latest technology to reduce food waste: The secret of long life can be found in packaging

Reducing food waste is one of the key factors in reducing GHG emissions. We will introduce the materials that MCC is developing to contribute to reducing food waste.

Note: The photos in this document include illustrations. The figures in this document are as of April 20, 2021.

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Article 1. Evolution of automobile materials: Automobiles are becoming lighter every year

The focus for the action plan in the field of the automobile/battery industries in the Green Growth Strategy Through Achieving Carbon Neutrality in 2050 is the promotion of vehicle electrification. The government has set a goal of achieving 100% electrified vehicles in the sales of new passenger cars by the middle of 2030. Accordingly, automakers are looking to reduce the weight of vehicle bodies, so carbon fiber and plastic materials that can replace metals are drawing attention. They are forecast to become the standard in the production of vehicles in the future. Here we introduce the materials that MCC is working on that will become the materials for the vehicles of the future.

Towards 2050

MCC will improve energy utilization efficiency and contribute to the reduction of GHG contained in vehicle exhaust gas through the development of materials that reduce the weight of vehicle bodies and materials for lithium-ion batteries, which are the key to electrified vehicles.
Electrified vehicles use lithium-ion batteries with a capacity of about 50 to 100 times that of hybrid vehicles, while plug-in hybrids use lithium-ion batteries with a capacity of about 10 to 20 times. Therefore, it is more important to reduce the weight of the vehicle body than gasoline vehicles.
Demand for lithium-ion batteries is expected to grow in the future. Along with this trend, improvements in material performance, high-speed and high-quality manufacturing processes, low-carbon emissions, and the establishment of reuse/recycling systems are required.

【Development of materials that reduce the weight of vehicle bodies】

■ **Carbon fiber SMC (Sheet Molding Compound)**
SMC is a type of intermediate base material for carbon fiber reinforced plastic (CFRP), which is a sheet-shaped material in which carbon fiber cut to a length of several centimeters is dispersed in the plastic. Since the weight of carbon fiber SMC is about 1/3 that of iron, it can reduce the weight of vehicle bodies, which is significantly related to CO_2 emissions. CFRP is a material that is attracting attention, as it is being applied to aircraft as well.

■ **Polypropylene, polyethylene**
Alternatives to iron and aluminum include long glass fiber reinforced polypropylene FUNCSTER™, which is excellent in rigidity and durability; light-weight polypropylene WAYMAX™, which lowers weight through outstanding foam molding; and polyethylene material Novatec™HD.

GR YARIS, which uses SMC (Photo courtesy of Toyota Motor Corporation)

Car door module that uses FUNCSTER™

Polyethylene automotive fuel tank

【Development of lithium-ion battery materials】

The four main components of lithium-ion batteries are the electrolyte, cathode materials, anode materials, and separator. MCC manufactures electrolyte and anode materials.

■ **Anode materials**
Our anode material generates an amount of CO_2 during manufacturing that is 60% less than that of products manufactured by other companies. The use of natural graphite reduces the generation of CO_2.

■ **High-performance electrolyte**
The electrolyte greatly contributes to the improvement of battery performance by the use of a functional additive that we have developed independently.

High-performance electrolyte and anode material

Our current initiative to realize KAITEKI ≈Comfort

★ Automobiles that use plastic materials can be manufactured to be thin and light while retaining high strength. Therefore, a car made with plastic will have more space inside than one using metals, even if the vehicles are the same size. This provides the added benefit of a comfortable interior space. The weight reduction of the material makes it easier for sound to be transmitted. To counter this, MCC has developed the world's smallest level sound absorbing material XAI™ by using ultrafine fibers. We plan to install this material in vehicles in the future.

Article 2. Development of bio-plastic: Plants to be used for applications such as the interior and exterior of vehicles and coffee capsules

Regarding the action plan in the field of resource circulation-related industries, the Green Growth Strategy Through Achieving Carbon Neutrality in 2050 states that the government is supporting technological development and social implementation through laws and planning. In the future, these efforts will be further promoted by advancing technology, improving equipment, lowering costs, etc. Regarding renewables, such as the use of bio-materials and recycled materials, we are promoting the replacement of fossil resource-derived plastics with renewable bioplastics and paper. Renewable material is one of the solutions to the problem of climate change due to the increase in GHG. We will introduce the materials that MCC is developing to protect the earth.

Towards 2050

In July 2020, charging for plastic shopping bags began, and there is a call for a review of environmental issues. Under such circumstances, the movement to switch to renewable plastics made from plants, such as sugar cane and corn, is underway. MCC will contribute to GHG reduction and the carbon cycle by developing plant-derived plastics.

In recent years, the durability, impact strength, heat resistance, transparency, and other aspects of plant-derived plastics have enhanced as a result of quality improvements. They are being used as interior and exterior materials for automobiles. The global trend toward future automobiles is being defined by the term CASE (Connected, Autonomous, Shared & Services, Electric). Regarding the “Electric” portion of CASE, we are contributing to energy efficiency of electrified vehicles by reducing the weight.

【Development of renewable plant-derived plastics】

■ **DURABIO™**

This engineering plastic is made from plant-derived isosorbide.
In addition to being lightweight, it has high impact resistance, heat resistance, scratch resistance, excellent transparency, and is resistant to weather discoloration. It is widely used for the interior and exterior design parts of automobiles, eyeglass lenses, mobile phone bodies, and other products. Compared to conventional engineering plastics, CO_2 emissions during manufacturing can be reduced by approximately 30%. It has superb color development and can take on a smooth, deep color like a mirror surface just by adding pigment, so it eliminates the need for painting. Furthermore, it is possible to significantly reduce the generation of CO_2 and VOC (volatile organic compounds) generated during painting and coating work.

Above: DURABIO ™
Middle: Mazda CX-8 interior parts
(Photo courtesy of Mazda Motor Corporation)
Bottom: Mazda CX-5 front grill
(Photo courtesy of Mazda Motor Corporation)

【Development of biodegradable plastic that decomposes into water and CO_2】

■ **BioPBS ™**

This biodegradable plastic is derived from plants. It can be decomposed into water and CO_2 by the power of natural microorganisms.
Biodegradable plastics are generally considered to be resistant to decomposition in ordinary soil, but BioPBS ™ has excellent biodegradability at room temperature.
Compared to general biodegradable plastics, it has excellent heat resistance and heat sealability. It is used in disposable tableware, paper cups, and food packaging materials because it complies with the food hygiene standards of other countries, including the US Food and Drug Administration (FDA).
In Europe, where awareness regarding environmental concerns is high, it is often used in coffee capsules that are not suitable for recycling because coffee extract residue remains inside.

Left: BioPBS ™ material
Products that use BioPBS ™
Bottom left: Paper cup
Bottom right: Coffee capsule

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★ Agricultural multi-film using BioPBS ™ has been put into practical use. Conventional plastics are difficult to recycle, and there is a labor and financial burden on collection and disposal after use. Since multi-film using BioPBS ™ does not require disposal, it also lowers the physical burden on aging farmers.

Article 3. Latest technology to reduce food waste: The secret of long life can be found in packaging

Regarding the action plan in the field of the food, agriculture, forestry, and fisheries, the Green Growth Strategy Through Achieving Carbon Neutrality in 2050 states that it is necessary to build a sustainable food system through the procurement of raw materials and energy as well as through efforts at each stage of supply chain, from food production to consumption. Food manufacturing emits GHGs throughout the entire process, starting with a processes such as food processing and ending with the incineration of discarded food as kitchen waste. Above all, wasting food is a problem close to consumers in a large food system. The incineration of discarded food as kitchen waste leads to GHG emissions. GHG emission due to food waste is reported to account for 8% to 10% of the world's total GHG emissions. We will introduce the materials that MCC is developing to contribute to reducing food waste.

Towards 2050

By developing food packaging materials that extend the life of food, MCC will reduce food waste, reduce GHG emissions due to food disposal, and contribute to carbon neutrality.
Food packaging materials support the extension of the life of processed products, such as instant foods and ham, by better gas barrier properties, moisture resistance, aroma retention, and chemical resistance. In addition, antibacterial and freshness preservation sheets are suitable for maintaining the quality of packaged and takeaway foods that have a short expiration date.

【Development of food packaging materials】

■ **Soarnol**™
Since it has a high gas barrier property, it is ideal for vacuum packaging and packaging filled with nitrogen, carbon dioxide, or other gasses. It is also used in mayonnaise containers to block oxygen, which can lead to quality deterioration. It is widely used in familiar products such as packages for salad chicken, which is lightly seasoned, boiled or steamed chicken breast and can be bought at convenience stores, and containers for jelly and rice in retort packages.

Products that use Soarnol™

■ **DIAMIRON**™
This high-performance packaging film material features improved performance through the lamination of multiple plastics with different functions. It has excellent transparency. It is used in the packaging of medical and pharmaceutical products.

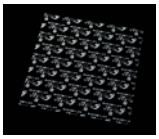
Products that use DIAMIRON™

■ **TECHBARRIER**™
This packaging material for retort foods has a high oxygen barrier property with silica vacuum-deposited on the surface of the plastic film, as well as a water vapor barrier property. It protects food even in high humidity.

Products that use TECHBARRIER™

【Development of antibacterial and freshness preservation sheet】

■ **Wasaouro**™
This antibacterial agent was researched and developed to maintain the freshness of food products and improve their shelf lives by applying the antibacterial strengths of allyl mustard oil contained in wasabi, a traditional Japanese ingredient. Various experiments and cases have confirmed that it exerts a high bacteriostatic effect on food poisoning bacteria, germs that cause decay, molds, yeasts, and more. This sheet type product is used for various packaged meals in Japan. It is attracting attention due to the increase in demand for take out foods due to the COVID-19 pandemic.



Right: Wasaouro™
Left: Usage example

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★ Foods wrapped in packaging materials that make their taste last longer are ideal for stocking in case of disasters. They are also suitable for new lifestyles due to the COVID-19 pandemic by helping to reduce the number of shopping trips.