

MIRACLES OF FOSSILS

Seeds of the future germinated
with the power of chemistry



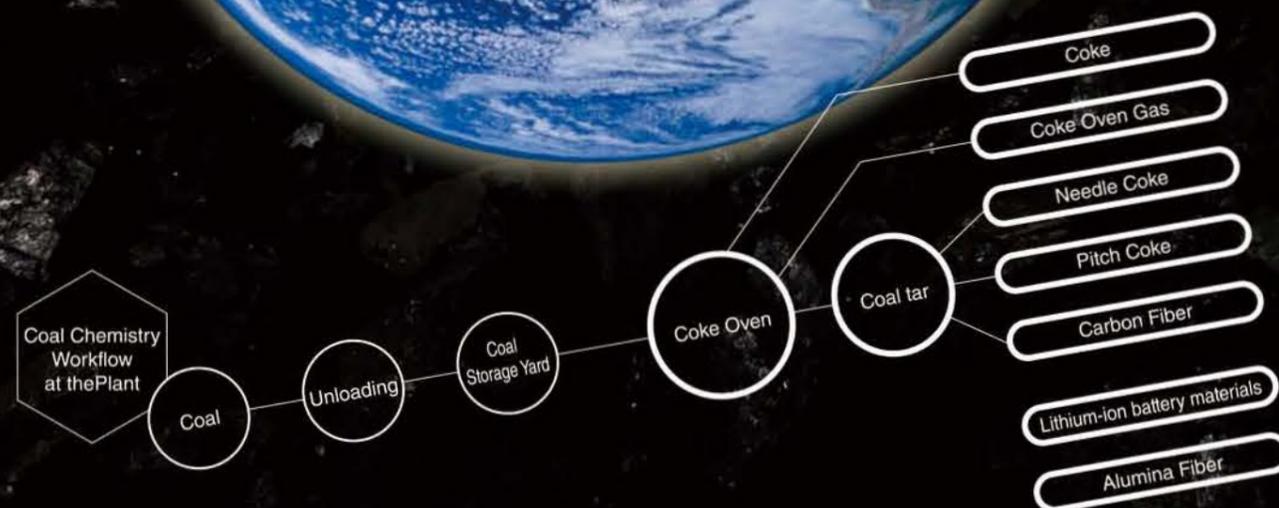
Coal, a 200 million year old energy source, is one of the greatest gifts that the earth has to offer for the future of human beings.

We explore the potential of this inspirational energy source through the development of human- and environment-friendly products.

Coal is a substance formed in ecosystems through millions of years of transformation of ancient plants with terrestrial pressure and geothermal heat.

This fossil fuel, the remains of ancient plants that have been bred in the arms of mother earth, is a wonderful gift from a distant past.

With our knowledge of chemistry, we convert this gift from the past into the energy for the present and into the future—that is truly a “miracle.”



Unloading



Coal Storage Yard

FURTHER DEVELOPMENT AND ADVANCEMENT WORLD-CLASS “COAL-CHEMICAL PLANT”

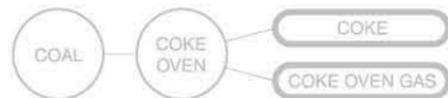
In 1969, the Sakaide Plant began its operation as the main plant for the Mitsubishi Chemical’s coke business inheriting the torch from a coke oven of the Kurosaki Plant in Kitakyushu. Since then, the coke ovens have never once shut down and the fire has been burning for 40 years to ensure the stable supply of cokes for iron production.



Coke Oven

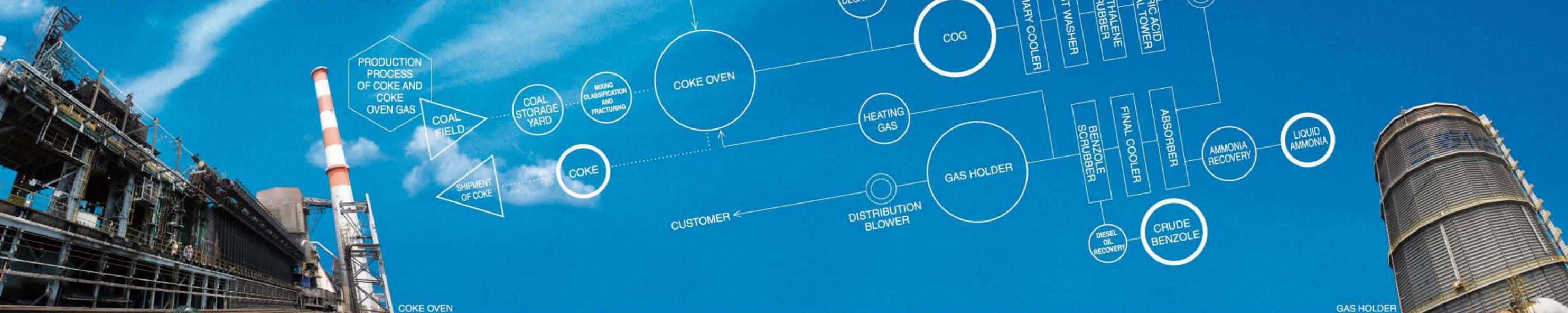
As well as supplying cokes for iron production, the Sakaide Plant has also been developing innovative products that can maximize the potential of coal by focusing on the by-products derived in the process of coke formation such as gas or coal tar. Development of electrode carbon materials such as Needle Coke or Pitch Coke and carbon products such as Pitch-based Carbon Fiber consequently led to a large expansion of the business. In addition, new projects designed for the development of lithium-ion battery materials or alumina fiber have been undertaken with the aim to further advance and enrich human life. The Sakaide Plant, Japan’s largest “comprehensive coal-chemical plant” that deals with coal and carbon, looks forward to continue contributing to the domestic and international societies through development of innovative technologies and attractive products. It is an honor to work together as a team of an international “coal-chemical plant” founded upon practical expertise accumulated through many years of focused commitment to corporate safety, security and environment. And we hope to continue providing high-quality, high added-value products and services that meet both domestic and international demands.





TECHNOLOGY TO BUILD A FOUNDATION FOR BIGGER GROWTH TOMORROW

A THOROUGH CIRCULATION SYSTEM TO ENABLE EFFICIENT PRODUCTION OF COAL PRODUCTS



COKE OVEN

GAS HOLDER



COKE

3.9 MILLION TONS OF HIGH-QUALITY COKE GENERATED WITH UNIQUE TECHNOLOGY AND MANAGEMENT SYSTEM

Coke is an essential material for blast furnace steel mills. The Sakaide Plant imports over forty different types of coals suitable for different uses. In order to ensure stability in quality, between 10 and 14 types of coals out of the forty are mixed and crushed into pieces about 1mm in size using Sakaide Plant's own technology. The coals are then charged into the coke oven and carbonized (coking) at temperatures ranging 1,100—1,200 degrees Celsius for 17 to 18 hours. The Sakaide Plant has 323 coke ovens that are 6—7 meters high and 15—17 meters deep, which are all equipped with highly advanced production control system that, for example, automatically controls the temperature of the oven due to the nature of each coal. Such need-based system enabled us to achieve an annual production capacity of 3.9 million tons of high-quality coke. Our cokes are used by major steel mills in Japan and overseas.



CENTRAL CONTROL ROOM

FROM COKE OVENS TO THE FUTURE ALTERNATIVE ENERGY WITH SIGNIFICANT POTENTIAL

The Coke Oven Gas (COG) that is produced during the coking process is utilized in many different fields. The COG removed of ammonia and purified is used in the plant as heating fuel for the coke ovens, as well as being sent to Shikoku Electric Power Co., Inc, a neighboring company, to be used as the fuel for thermal power generation.

Other byproducts generated in the process of purification of coke oven gas, such as ammonia, sulfur, or crude benzole are also suitable for industrial use. It is now our desire to discover new and effective utilization of COG, considering its characteristic that it is composed of approximately 60 percent hydrogen. The Sakaide Plant especially focuses on the development of earth- and environment-friendly, next-generation energy technologies.



SULFURIC ACID REMOVAL TOWER

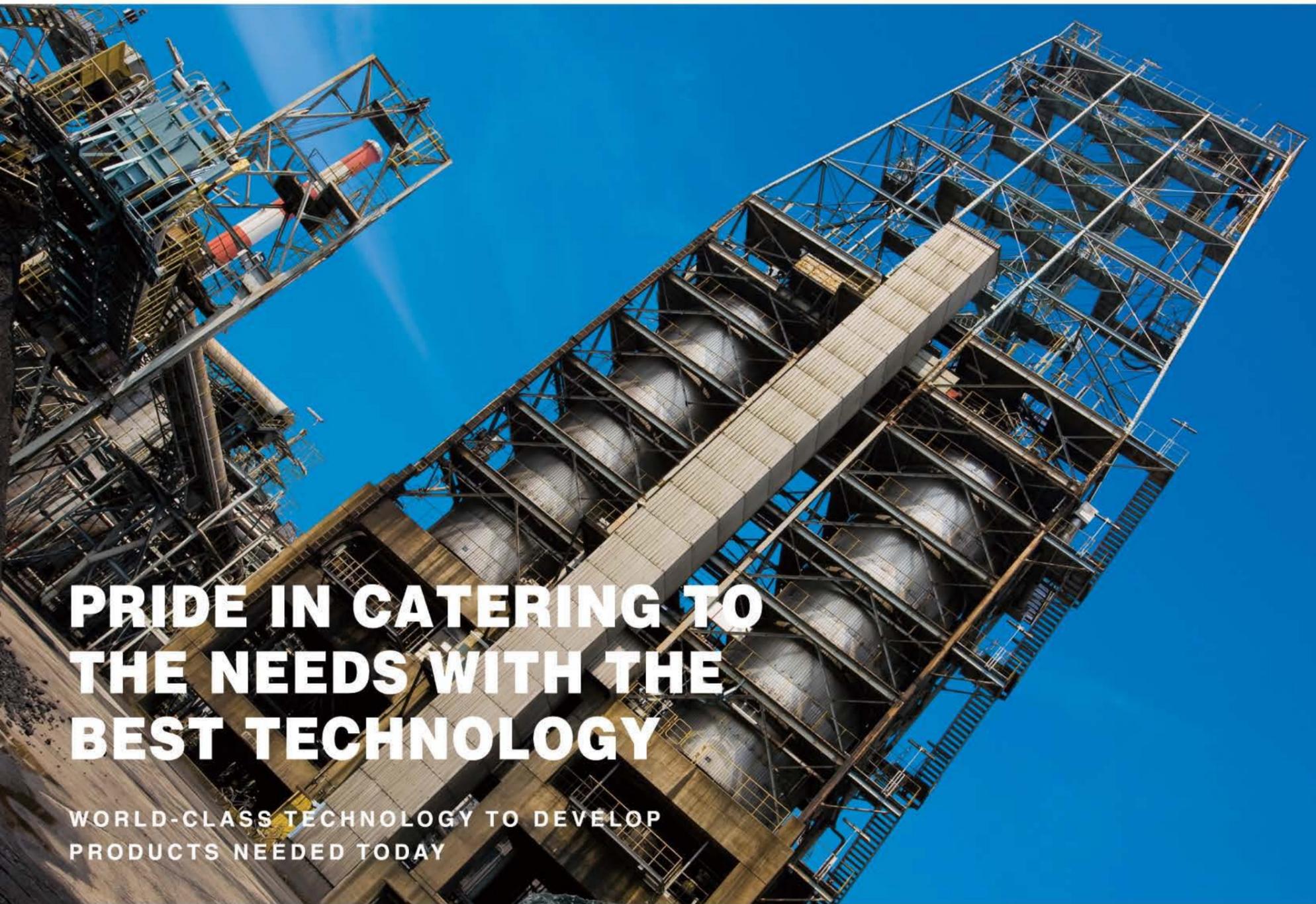
A TIP FROM CHEMI-KAERU-kun

TO PROTECT OUR BEAUTIFUL EARTH, WASTEWATER TREATMENT IS PERFORMED 24 HOURS A DAY!

All of the wastewater generated by the Sakaide Plant, including the water discharged from coke ovens is processed through deammoniation, activated sludge process, filtration, and activated carbon adsorption.

Processed water is also monitored with various sensors and analyzers around the clock. The Sakaide Plant gives due consideration to the protection of global environment and ecosystem by implementing water management method according to the regulations prescribed by the Water Pollution Control Law.





PRIDE IN CATERING TO THE NEEDS WITH THE BEST TECHNOLOGY

WORLD-CLASS TECHNOLOGY TO DEVELOP PRODUCTS NEEDED TODAY

TWO COKE DRUMS FOR HEAT TREATMENT

Two coke drum towers in the center of the Sakaide Plant. Green (raw) cokes are produced by charging the coke drums with high-temperature material pitch, leading heat decomposition and polymerization reaction. These important facilities are controlled with an advanced Factory Automation (FA) System and Computerized Automatic Optimization to maintain suitable manufacturing condition, which are both intricately linked with the main production management system of the plant, so that the entire process from raw material coal tar to finished products is managed in a uniform fashion.



NEEDLE COKE

PITCH COKE

FLEXIBLE TRANSFORMATION OF COAL TAR WITH OUR NEW-VALUE-ADDING TECHNOLOGY

Needle cokes are used as a primary material for electrode used in an electric steel furnace that melts and refines steel scrap. It took us nearly a decade to finally produce world's first coal-based needle coke. Compared to the conventional oil-based needle coke, the coal-based needle coke has certain distinguishing characteristics, such as high heat durability and world's lowest thermal expansion rate.



ELECTRODE FOR ELECTRIC STEEL FURNANCE

ELECTRIC STEEL FURNANCE

Pitch cokes that are also produced from coal tar are an essential material for building production equipment for semiconductor or solar array panel. The Sakaide Plant manages the manufacturing process in a uniform fashion to ensure stable provision of high-quality products, as well as conducting an intense and profound study to contribute to the development of next-generation systems that are capable of further growth.



CARBON BRUSH FOR ELECTRIC MACHINES

SILICON WAFER AND RELATED PRODUCTS

ELECTRONIC FUNCTIONAL MATERIALS

OUR TECHNOLOGICAL BREAKTHROUGH WAS INTERNATIONALLY RECOGNIZED AND REWARDED WITH THE PRESTIGIOUS OKOCHI MEMORIAL PRIZE



We were awarded the 27th Okochi Memorial Prize for "establishing manufacturing technology for coal tar-based needle coke." The prize is presented to honor individuals and enterprises who demonstrate outstanding achievements in industrial production, and is recognized throughout various fields of technology as one of the most prestigious prize.

A TIP FROM CHEMI-KAERU-kun



TO DELIVER WORLD CLASS QUALITY!

High-quality needle cokes are absolutely imperative in creating excellent electrodes that can endure high temperature over 3,000 degrees Celsius. Ensuring high quality products is also an important job. For example, there is the "thermal expansion coefficient measurement device," which we use



THERMAL EXPANSION RATE MEASUREMENT DEVICE

to heat the product samples to a high temperature in order to maintain low thermal expansion coefficient to prevent cracking and such. We are performing various analysis on a daily basis at the Sakaide Plant.



PASSION IN MAKING CONTRIBUTIONS TO EVOLUTION WITH MICRO TECHNOLOGY

MEET THE EVOLVING MARKET NEEDS WITH OUR KNOWLEDGE AND TECHNOLOGY TO CREATE CONCENTRATED POWER



CONVERTING ANODE MATERIALS INTO PRODUCTS

Anode material is coated on copper foil and made into an electrode. Electrodes are built into batteries for cellular phones and laptop computers, and most likely for hybrid (electric) cars.

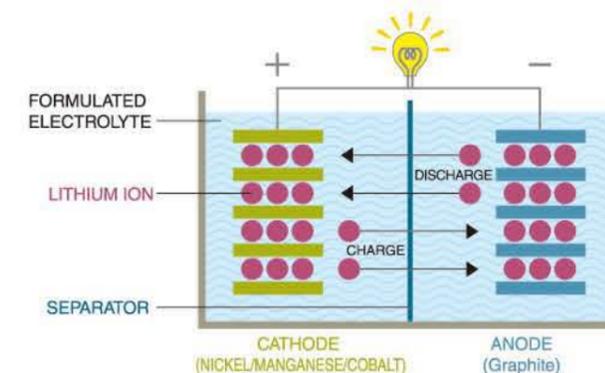


BATTERY MATERIALS WITH OUTSTANDING HIGH-ENERGY DENSITY TO MEET THE EMERGING NEEDS

The Sakaide Plant develops lithium-ion battery materials that have the world's highest energy density. We manufacture two types of carbon-based anode materials — the high-power “MPG” and high-capacity “ICG.” Mitsubishi Chemical is the world's only company that provides all four key materials: anode materials, cathode materials, formulated electrolytes, and separators.

Taking advantage of our knowledge and advanced technologies as the integrated chemical company, we provide major battery makers with advanced materials to meet the diversifying market needs. We continue to move forward with establishing stable supply chain as well as developing high-performance materials in pursuit of the hybrid cars applications.

RESEARCH FACILITY TO SUPPORT STABLE PRODUCTION OF ANODE MATERIAL



OPERATIONAL MODEL OF LITHIUM-ION BATTERY

A TIP FROM CHEMI-KAERU-kun

THE SECRET OF LITHIUM-ION BATTERY AND HIGH-ENERGY DENSITY

In lithium-ion batteries, the lithium ion moves between anode and cathode electrodes during the repeated cycles of discharging and charging. The exceptionally small lithium ion easily moves between the electrodes and achieves several times of energy density compared to the nickel-metal



hydride batteries. It is suitable not only for small and lightweight cellular phones or laptop computers but also for hybrid cars that require a large amount of energy.





ABILITY TO CREATE WORLD-LEADING PRODUCTS

WORLD'S FINEST QUALITY PRODUCTS TO SUPPORT THE DEVELOPMENT OF TECHNOLOGY



WORLD'S LEADING TECHNOLOGY HIGH-PERFORMANCE CARBON FIBER TO REPLACE STEEL

"DIALEAD[®]," a coal tar-based product of Mitsubishi Plastics, is a coal tar pitch-based carbon fiber successfully commercialized for the first time in the world. Due to its highly desirable characteristics — lighter than aluminum and firmer than steel, high thermal conductivity, and low thermal expansion coefficient — it is now being used in a wide variety of fields, such as aerospace, robotics, or industrial machinery.

Since the successful commercialization of the product, the Sakaide Plant has been manufacturing "DIALEAD[®]," the high-performance carbon fiber with a core diameter of 10μ from coal-tar-derived mesophase pitch and by performing a spinning process and a high temperature heat treatment process. "DIALEAD[®]," the high-performance carbon fiber we have been manufacturing since the commercialization, is expected to be applied in many fields including automobile industry and renewable energy industry as a highly efficient environment-friendly material. We are also working proactively to deliver composite materials which will be applicable in many other fields.



ROBOT HAND
A courtesy of YASUKAWA Corporation



SOLAR OBSERVATION SATELLITE "HINODE"
A courtesy of JAXA



BRAKE DISK



CARBON ROLL
A courtesy of Sunray co., Ltd.



"DIALEAD[®]" — A WORLD'S LEADING CARBON FIBER



CHOPPED FIBER



A RESEARCH SYSTEM EQUIPPED WITH THE LATEST TECHNOLOGY

Research and development of carbon fiber composite materials using various matrices are conducted.



A TIP FROM CHEMI-KAERU-kun

THE FIRST INVENTOR OF CARBON FIBER WAS EDISON!

The history of carbon fiber is very long. It is said that the carbon fiber was first brought to life by Thomas Edison when he used burnt-bamboo slivers as the filament for his electric bulb. The development of bamboo slivers was discontinued as substitute



materials were discovered, however, it regained world attention after the war. The Sakaide Plant, based on its coke-related technology, succeeded in creating pitch-based carbon fiber, which is now used in daily commodities and in space technology.



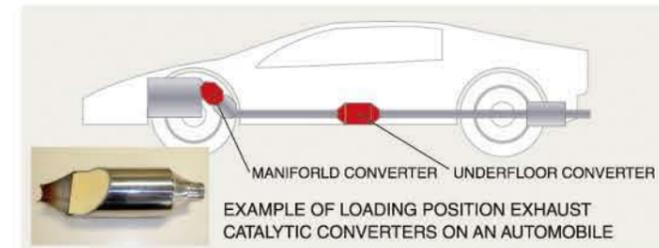
SPIRIT TO DELIVER ENVIRONMENT-BENEFITTING PRODUCTS

PROTECT THE IRREPLACEABLE ENVIRONMENT OF THE EARTH WITH THE STATE-OF-THE-ART TECHNOLOGY

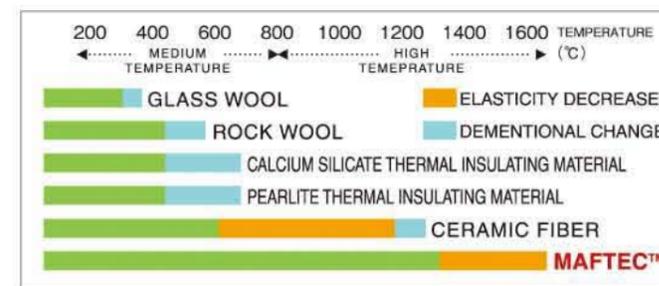


HIGH HEAT-RESISTANCE CONTRIBUTES TO ECOLOGICAL WELL-BEING ALUMINA FIBER ACHIEVED THROUGH UNIQUE PRODUCTION TECHNOLOGY

Alumina fiber is composed of alumina (aluminum oxide) and minor portion of silica (silicon dioxide). It is characterized by lightweight, high fire-resistance and heat-insulating properties, little deterioration and low shrinkage in high temperature, and high cushioning properties. Our product "MAFTEC™" especially excels in terms of mechanical strength and stability in dimensions at high temperature and is gaining attention as a lightweight insulating refractory material and convertor support mat to purify auto exhaust.



"MAFTEC™" is produced by making the compound liquid of alumina and silica into filaments and assembling the filaments into a blanket-like three-dimensional framework, firing, and crystallizing them. Through this production process that causes the fibers to intertwine, strength and cushioning properties are greatly increased. Further development of the technology is being carried out to improve quality and productivity in order to satisfactorily meet the demands concerning emission control and energy-conservation.



RANGE OF OPERATING TEMPERATURES OF VARIOUS THERMAL INSULATING MATERIALS

Comparatively little physical property changes are caused in MAFTEC™ under high temperature.



MAFTEC™ is used in automotive catalytic converters

A TIP FROM CHEMI-KAERU-kun

Change the future with the power of chemistry.
That's our mission!

"MAFTEC™" is a type of fiber made of ceramic that is used in pottery and porcelain. By stretching out the melted high-purity ceramic solution at room temperature and then heating it, we've created the "magic cotton" with high thermal strength up to 1600°C, in which even iron or glass would melt. This earth-friendly material will be evolved further in terms of energy-conservation and exhaust purification.



“TECHNOLOGY” AND “TRUST” THAT CULTIVATE THE FUTURE

AS A TRUSTWORTHY PARTNER TO CREATE A BETTER COMMUNITY THROUGH
CONTINUOUSLY DEVELOPING OUR TECHNOLOGY



SAKAIDE PLANT RC POLICIES

1. ACHIEVING ZERO ACCIDENT

We are striving to prevent facility-, environment-related accidents and occupational accidents by risk/environmental impact assessments of operations and facilities, and also by scientific analysis for past cases.

2. HARMONIZING WITH THE NATURE

Considering that our plant is located within Setonaikai National Park, we will exert maximum effort in preventing pollution of air, water, and soil.

3. PROVIDING OF QUALITY AND SERVICES DEMANDED BY THE CUSTOMERS

We contribute to the prosperity of society by providing products and services that respond to customer's needs and requirements.

4. ENHANCING OUR PUBLIC REPUTATION

By complying with the laws and agreement made with prefecture, city, town, and within the company, we will increase public trust. We will also continue developing safer and more environment-friendly products.

5. SAVING RESOURCE AND ENERGY

We will actively engage in the recycling of waste materials while giving due consideration to the effective utilization of resources and energy.

6. COLLECTING AND PROVIDING OF THE LATEST INFORMATION ON RAW MATERIALS AND PRODUCTS

To prevent accidents and disasters which may be caused during handling of chemical and raw materials, and also when distributing, using or disposing of products, we will collect the latest safety information and environmental impact data, and will provide the information and data to business partners as necessary.

7. COEXISTING WITH REGIONAL COMMUNITY

Through close communication with the community, we will contribute environmental conservation for the community.



CHARACTER OF SAKAIDE PLANT
CHEMI-KAERU-kun

The Sakaide Plant strives to always be trusted throughout the community as well as being responsible for establishing an industrial foundation internationally.

In order to fulfill our corporate responsibility for the community and the environment, we have set RC policies and enforced RC activity to ensure “Quality,” “Environment,” and “Safety.”

We give top priority to the conservation and maintenance of local environment while also contributing to the vitalization of the region in cooperation with the community

“OUR MITSUBISHI CHEMICAL”

We earnestly desire to be referred to as such.

QUALITY

PRODUCTION OF HIGH QUALITY PRODUCTS THAT MEET THE CUSTOMER NEEDS THROUGH A STRUCTURED QUALITY MANAGEMENT SYSTEM

Our Quality Management System is certified under ISO9001.



ENVIRONMENT

ESTABLISHMENT OF ENVIRONMENT MANAGEMENT SYSTEM WITH THE AIM TO PRESERVE NATURE AND ENVIRONMENT

Our Environment Management System is certified under ISO14001.



SAFETY

ESTABLISHMENT OF OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM TO ENSURE PROCESS SAFETY AND DISASTER PREVENTION AND WORKPLACE SAFETY

●PROFILE CHEMI-KAERU

Represents flexibility and vitality of the Sakaide Plant. It's role is to closely determine what needs to be maintained and what needs to change and pass them along to the future.

POWER OF CHEMISTRY TO NURTURE THE GIFT FROM THE PAST

Sakaide Plant converts coal, an energy source that has been held in the arms of mother earth over 200 million years, into shapes most suitable for the present purposes to support the future of the human race and planet Earth — that is truly a "miracle."



*Good **Chemistry** for Tomorrow*

Mitsubishi Chemical Holdings Group

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