WITH MATERIALS



Special Feature Using the Power of Technology to Create the Future

CONTENTS

SPECIAL FEATURE 02

Using the Power of Technology to Create the Future

12 COMMUNITY

Visiting a Town with MM Sambo Plant

PEOPLE 14

MY STORY

Kim Jae-won Rock Tools Group, Sales Div., MMC RYOTEC Corporation

TECHNOLOGY 16

The Power of Materials Builds Society Aerospace

PRODUCT 18

The Secrets of Materials CO₂ decomposition and recycling technology

TOPICS 19

SUSTAINABILITY 20

Forests and Materials With Horses

Using the Power of Technology to Create the Future

Currently in the world, various social issues such as global warming, depletion of energy resources, and ever-increasing waste are piling up.

We at Mitsubishi Materials are facing these social issues head on and aiming to contribute to the building of a "prosperous," "recycling-oriented," and "decarbonized" society by focusing our energy on research and development of new materials in four fields: next generation vehicles, IoT & AI, urban mining, and clean energy & decarbonization.

Everyone engaged in research and development at Mitsubishi Materials continue to create original products and technologies with a strong sense of mission "Materials create the future." Here, we will introduce some of their voices.



A prosperous society

> Post LIBs

A recyclingoriented society

Megacities

Carbon neutrality





health care

03

Unique **Technologies** and **Products** to Create a Prosperous Future

Over the years, Mitsubishi Materials has developed competitive technologies. We want to share with you how we are using this technological strength to contribute to the resolution of social issues.

Core technology

🔊 Alloys 🔊 Plating 🛞 Surface treatment 🚯 Resin

Shaping Powder metallurgy Bonding Nanomaterial High purification Facility design Scientific computing Analysis

Supporting the spread of next generation automobiles **High performance copper alloys**

With the evolution of autonomous driving, electrification of various systems, and the introduction of wireless networks, the use of driving sensors, electrical components for vehicle control and equipment, and high-current circuits is increasing. The copper products used in these areas are required to have high strength, high electrical conductivity, and be able to resist spring deterioration. Mitsubishi Materials' MSP series copper alloys fulfill these requirements, and are currently adopted as the material for small terminals, high-frequency terminals, and high-voltage terminals. Although hidden from view, these materials increase the functionality of automobiles and contribute to the spread of next generation automobiles.

In addition, MOFC-HR, an oxygen-free copper with the world's highest standard in strength and heat resistance, has been successfully developed. It is the optimum material for electrical components for EV and next generation energy systems that require high-current and high-heat dissipation capability in harsh environments.

Fulfilling both workability and connectivity Plating for car connector terminals

Copper

alloys & oxygen

free copper

MSP series

MOFC-HR

With the advancement in the electrification of cars, connectors for electric parts have been reduced in size and multi-polarized. Because of this, the connector terminals have an increased connection area and there have been problems inserting the connectors due to friction. Normally, copper alloys for connector terminals have their surface treated with reflow tin plating for highly reliable electrical connections, but there were limitations in how much frictional resistance could be reduced. In response to this issue, Mitsubishi Materials applied the Group's own unique technology and succeeded in creating PIC Plating (PIC: Precise Interface Control) that possesses both the ability to reduce frictional resistance and electrical connection reliability. A new way to reduce the coefficient of dynamic friction of plated surfaces by about 30% compared to the original method was born.

Surface treatment

Al-rich coating





Sticking to a surface and reducing its thermal resistance A new clay-like resin material

The advancement of the function of automobiles and electronic devices causes the machines to heat up, causing heat dissipation problems to rise. This has increased the need for thermal conductive materials. These materials are placed between high-temperature components, such as lithium-ion battery modules and electronic circuit boards, and low-temperature heatdissipating components, such as heat sinks, to facilitate the heat transfer over. Mitsubishi Materials had set out to develop "thermal conductive putty," a new thermal conductive material. Since it is soft like clay, it can adhere to a component's surface. So, unlike the conventional thermal conductive rubber sheets, "thermal conductive putty" can be expected to reduce the thermal resistance generated at the contact surface. The development is currently ongoing toward the practical application of this technology.





Cutting tools with the sharp-edged parts set at machine tools are used to process hard metals. In order to improve wear and heat resistance with longer tool life, we cover the surfaces in (Al, Ti) N (aluminum titanium nitride*) coating. However, it has been thought that there were limits to the improvement of wear and heat resistance.

Mitsubishi Materials decided to exceed these limits. Through the new coating process made with our unique technology, we succeeded in developing Al-rich (aluminum rich) coating, a coating that lasts more than four times as long as conventional products, even in high temperature environments. By enabling higher cutting speeds and more efficient processing than conventional products, the new products drastically cut down on processing time and are contributing to manufacturing in various industries. *Coating made from Al (aluminum), Ti (titanium), and N (nitride)



\langle The potential of Materials will grow from here \rangle An Environment for Innovation

Research and development at Mitsubishi Materials is conducted by the Innovation Center (mainly the four bases: Naka, Omiya, Kitamoto, and Onahama) and the Incubation Center, which are execution units under the Monozukuri and R&D Strategy Division of the Strategic Headquarters.

In 2019, so that we could more quickly respond to social changes, we reformed into a flexible organizational structure to realize the fusion of knowledge from multiple specialized fields. With a free environment to encourage the emergence of ideas, we have accelerated the creation of new products and technologies.

Creating an environment for smooth idea creation

As a way for the researchers to use their curiosity and develop new themes, we are introducing various systems, such as our "10% Culture," and building an innovative culture. In 2019, to help researchers envision new research topics without feeling trapped by the already existing frameworks of business and technology, we initiated the Future Business and Technology Creation Area. Our researchers freely create new ideas that will become the seeds of our future business and are taking on the challenge of new projects.



I want to create the world's first technology

Onahama Branch

Naka

Omiya Branch

Innovation

Kitamoto

Incubation

Center

Branch



Shunpei Suzuki First member Future Business and Technology Creation Area

There were many subjects that I wanted to get involved with one day, so with no hesitation I decided to take part in the Future Business and Technology Creation Area. The topic was biology related, something that we had not dealt with at our company, and is the world's first development of a process in which microorganisms are used to collect precious metals. I worked with this project for two years. I spent half a year gathering information and drafting up plans. After that, I took another half a year to reach out to about 100 research centers to look for partners and to start the project. The remaining year was spent performing basic experiments. We were selected as a New Energy and Industrial Technology Development Organization (NEDO) project and received funding, so we continue to investigate the commercialization of this process.

At the Innovation Center, we are working on creating an organization environment fit for the next 100 years. As a part of that, we have migrated from a vertically divided organization into a flexible organizational structure that spans multiple specialty fields. Additionally, we are now a flat organization, so all researchers work directly under the center manager. This makes it easier to gather all the people a project leader has requested, and it has also created an

Individual deepening and co-creation : Changing organizational climate by changing the work environment

As part of the plan to improve our organizational culture, we are reforming the work environment for our researchers. We have employed a well thought out room layout which incorporates the themes of "individual deepening," the creation of an environment that meets each individual's needs and helps them to work efficiently, and "co-creation," the creation of an environment which encourages the interactions between researchers from different fields to help create new ideas.



Researchers are always seen gathering and having lively discussions in our wideopen café space filled with natural lighting.

Using data to promote efficiency

Utilizing Materials Informatics

To enable rapid development to meet the diversifying needs of various materials, we are now making data-driven efforts with machine learning and AI based on data science, also known as Materials Informatics (MI), rather than the conventional methods that relied on the process of trial and error.

discovery of new materials. Mitsubishi Materials Informatics Research

environment where instead of waiting for commands from above, researchers are self-motivated to get involved in the research.

Moreover, thanks to the implementation of online communication tools, everyone is more active in transmitting and sharing of information and everyone's knowledge is merging. All of this has made it easier to develop research themes with novel and new approaches and we are seeing results.

An environment that naturally encourages communication



Moe Sakaguchi Secretariat Room Layout Reform Project

We have four main bases for Innovation Center: Naka, Omiya, Kitamoto, and Onahama. Naka was the first to reform their room layout. We didn't just make the interior look nicer. With organization reform in mind, we conducted a questionnaire with all the researchers at various facilities and got a range of feedback. Since the reform decision was made after everyone had evaluated multiple proposals. I think the changes will result in high satisfaction. By making the office space into a free-address office, researchers can more actively communicate with researchers they normally wouldn't interact with. The concepts of "individual deepening" and "co-creation" are slowly becoming a reality.



Combination of strength and heat resistance of the world's highest standard

The Path to the Development of MOFC-HR (Mitsubishi Oxygen Free Copper - Heat Resistance)

In 2021, Mitsubishi Materials developed MOFC-HR (Mitsubishi Oxygen Free Copper – Heat Resistance), a new oxygen free copper with the world's highest standard of strength and heat resistance. This material has characteristics which will advance the electrification of automobiles and the spread of next-generation energy, contributing to a sustainable society. We want to share with you the strenuous efforts of the people that went into the development of this new material.



Kazuyuki Iwaki Group I Rolled Product Sales Sect., Rolled Product Dept. Copper & Copper Alloy Business Unit Advanced Products Company Kazunari Maki Senior Researcher Innovation Center (Kitamoto Branch)

Copper materials evolve in the age of electrification

Mitsubishi Materials has developed an integrated Copper and Copper Alloy Business, from copper smelting to wrought copper products. For many years, the company has been developing a variety of copper products to satisfy customers' needs, and particularly excels in the development and manufacturing technologies of oxygen free copper and its alloys.

In recent years, the electrification of automobiles and the spread of nextgeneration energy has led to the demand for materials of electrical components that can handle large electric currents and have high heat dissipation capability. For this reason, the use of oxygen free copper, the copper material with the highest electrical conductivity and heat conductivity, is rapidly spreading. However, when pursuing higher reliability or functionality, a problem with existing oxygen free copper was its insufficient strength and heat resistance.

"Those engaged in research and development for a company have a mission to release technologies into the world and to create things that help people. We at Mitsubishi Materials must continue to evolve our specialty oxygen free copper to fulfill the customers' needs," says research and development supervisor Maki.

Exploring the possibilities without fear of failure

Five years ago, at the Innovation Center Kitamoto Branch where research and development of metal materials is performed, Associate Researcher Ito's team was exploring the possibilities of oxygen free copper. "It was believed that the electrical and heat conductivity, which are the strong points of oxygen free copper, were a trade-off for strength and heat resistance. However, customers desired something that had both high electrical conductivity and strength, and not making this happen would hinder the advancement of electrification. To meet their expectations, we tested various compositions through trial and error without fear of failure, and we discovered an interesting phenomenon where an increase in strength did not decrease electrical conductivity as much as we had anticipated. As a researcher, it was a



very rewarding moment."

Don't be afraid of failure. Mitsubishi Materials Innovation Center has an environment where, during the basic research stage, researchers are free to explore possibilities without worrying about the outcome. This development was successful due to this environment.

Mr. Fukuoka was responsible for taking the seeds of discovery from Mr. Ito's basic research and brushing them up for productization. "As we made adjustments to the characteristic parameters to optimize the performance, I became more and more convinced with the potential of this material. I would get excited just thinking about the kinds of equipment this oxygen free copper would be used in after overcoming its weaknesses. There is no doubt MOFC-HR will have an impact on manufacturing."

Following lab verification, it was finally time for trial production at Wakamatsu Plant. Initially, there was a variation in the performance, and we went back and forth between trial production and lab verification. Mr. Morikawa of Wakamatsu Plant reflects on this period: "It was not an easy task to reproduce the characteristics we discovered in the

Those engaged in research and development for a company have a mission to release technologies into the world and to create things that help people.







lab on mass production machines and to establish a process that achieved the specifications that would meet the requirements of our customers. I became keenly aware of the difficulty of launching a new product that had characteristics of the highest standard in the world. But now, I feel lucky to have been part of the process. I want to make MOFC-HR the new standard for oxygen free copper."

Dialogue inside and outside the company speeds up innovation

Project Manager Suehiro determined the success of this project would not have been possible without the teamwork from both inside and outside the company. "Our company has a flat organization, and this atmosphere allows everyone to freely express their opinions of how to reach the goal without worrying about superior or subordinate relations. Team strengths allowed ideas to spread, and it made for a speedy progress. The process didn't only take place in the company; we also received many customer inputs from the development stage onward. I believe all of us coming together as one team to meet the needs of the world is what enabled us to create a new product with the capacity of meeting the world's highest standard.

Mr. Iwaki of sales, who was responsible for keeping everyone updated on customer needs, shared the same opinion. "With Innovation Center, Wakamatsu Plant, and the sales division coming together as one, we were able to hear the voices of many customers, helping us to develop a material that matched their needs. One customer has already assessed MOFC-HR and has highly praised the balance of its superior electrical conductivity and strength, which is its greatest advantage. If the material is strong, there is also the merit of being able to downsize the thickness of the sheet, cutting material costs. I will continue to connect customers with our company so that this material is adopted."

A material that is useful to the world and changes the future

After the MOFC-HR press release went public in September 2021, many customers reached out to us with their opinions. With the electrification of our society, there is a high expectation for high strength, high heat resistance oxygen free copper for use in many applications such as high voltage terminals for automobiles, bus bar modules, charging connectors, relay sockets, battery tab leads, power modules, lead frames, heat sinks, and so on.

The project team members share a common desire: to create a material that would be useful to the world. They all voiced in chorus that unless the material is actually used, creates value for society, or protects the future of the earth, it has no meaning. In order to meet the needs of the world, Mitsubishi Materials' research and development team will continue to endlessly take on new challenges. Dialogue between universities and companies is essential for realizing a recyclingoriented society

GUEST CROSS TALK

Masayoshi Kohinata Senior Researcher Innovation Center (Onahama Branch)

Connecting the Arteries and Veins of Industry to Realize a Recycling-Oriented Society

Dr. Toshiaki Yoshioka of Tohoku University, who is conducting joint research with our company, and Senior Researcher Kohinata discuss the future that they are aiming for together.

Kohinata: We are conducting joint research with your laboratory to realize a resource- and material-recycling society. Could we start by reviewing your research goals? Yoshioka: My laboratory aims to realize a resource- and material-recycling society through research on chemical recycling of waste materials. When conducting joint research, we ask our partners to provide us with knowledge from their production sites so that we can use the results of our academic research for the business development of companies. To create a recycling-oriented society, we must connect the arteries that create new products with the veins that recycle them.

Kohinata: Our company has been involved in the recycling of copper and other nonferrous metals for a long time. In recent years, due to the depletion of mining resources and environmental issues, we have focused on urban mines and are increasing the ratio of E-Scrap utilization. You are working on resource recycling of waste plastic, correct?

Yoshioka: Many things in the world, including E-Scrap, are composed of metal and plastic. It is difficult to recycle plastics when metals are contained, so in collaboration with Mitsubishi Materials and several other companies, we are researching plastic recycling technology with a view to applying it to the technology for recovering useful metals and other materials. Technologically, this is feasible, but the issue is creating a system for resource circulation. A circular economy is not possible with our society's long ingrained linear economy criteria. We will have to change our way of thinking. Kohinata: The Graduate School of Environmental Studies at Tohoku University blends a wide range of disciplines, incorporating social sciences such as environmental policy studies. Environmental issues are complicated and entangled, so we cannot achieve a recycling-oriented society with technology alone. Dialogue between academia and companies is also essential. What are your expectations of Mitsubishi Materials as a joint research partner? Yoshioka: I think your strength is that you are active in a wide

Yoshioka: I think your strength is that you are active in a wide range of fields and have various points of contact with society. On the other hand, there also may be drawbacks associated Please use the capabilities of Japanese companies in the circular economy

Toshiaki Yoshioka

Doctor of Engineering Special Assistant to the President (Green Future) Professor at the Graduate School of Environmental Studies, Tohoku University

- with being such a large organization, such as a lack of speed and a lack of deep understanding of each other's research in different fields, even within the same company. I think that improving internal collaboration would enhance the effects of industry-academia collaboration even more.
- Kohinata: You're quite right. That is precisely why we are working to reform our R&D culture, changing our organizational structure, and using IT tools to revitalize communication. Do you have any suggestions for industry? Yoshioka: Thinking back on the past, I think that many projects and studies on recycling were abandoned because they were not profitable to the industry. However, those projects may be more feasible now. Unlike the world of manufacturing, I believe resource recycling is a field where past research results can be utilized, so please do your research carefully.
- Kohinata: Yes, we need to get rid of this idea that old research is old technology. I would be glad to reuse the knowledge of resource recycling that our predecessors accumulated over the years.
- Yoshioka: People have been saying that Japanese companies are lackluster for a while now, but our research is not lagging behind, and we have a sound technological foundation.
- Let's incorporate our capabilities into the circular economy. I believe that Mitsubishi Materials possesses many excellent technologies, and I hope that you will actively promote them to the world from the concept stage, before they take shape, to get a head start on the market.
- Kohinata: We will strive to meet your expectations, commercialize the university's cutting-edge research results, and contribute to the realization of a recycling-oriented society.

Toshiaki Yoshioka Profile Professor at the Graduate School of Environmental Studies at Tohoku University since 2005. He has served in a number of important positions, including President of the Japan Society of Material Cycles and Waste Management, technical committee member of the New Energy and Industrial Technology Development Organization (NEDO), and advisor to the Japan Science and Technology Agency (JST), etc.

Visiting a Town with MM

Ms. Stride, a woman traveling around the world, visits a town where a Mitsubishi Materials Group hub is located.



Navigator Ms. Stride A woman in her late twenties who enjoys factory tours and strolls around town.

Osaka

Sakai Citv

It's fun to see

the tombs

Sambo Plant edition

In this edition, we will introduce the town where the Sambo Plant. which plays an important role in Mitsubishi Materials' Copper & Copper Alloy Business, is located.

The Sambo Plant is in Sakai City, Osaka Prefecture, where the Mozu-Furuichi Kofun Group, a world heritage site, is located. Its slogan is "Bon voyage of faith." As a manufacturing base for wrought copper products, the plant is committed to manufacturing with sincerity and providing high guality products to various industries.

The Tomb of Emperor Nintoku One of the world's three largest tombs

The Tomb of Emperor Nintoku, one of the tombs of the Mozu-Furuichi Kofun Group, a world heritage site, is Japan's largest keyhole-shaped tumulus with a length of 486 m. It is one of the three largest tombs in the world together with the Mausoleum of the First Qin Emperor in China and the Great Pyramid of Giza in Egypt. The observation lobby on the 21st floor of Sakai City Hall is recommended to fully appreciate its shape from above.

The Hankai Tramway, "Chin-chin densha (Ting-a-ling Train)" Enjoying the scenery from the window

The Hankai Tramway (commonly known as the "Chinchin densha") is a tram that runs at a leisurely pace from north to south through Osaka. It has served as a means of transportation for the citizens of Osaka for more than 110 years.



Makoto Shibata Assistant to the General Manager Administrative Department

Joined the company in 1985. He is involved in compliance training and risk management. His local recommendation is Kansai udon which are made with a delicious broth. Among them, his favorite is the curry udon at the canteen of Sambo Plant.

Sen no Rikyu A historical figure of Sakai City

One of Sakai's most well-known historical figures is Sen no Rikyu, the great master of the Japanese tea ceremony. He was born in Sakai and spent most of his life there. The Sakai Risho no Mori, a museum that showcases the history and culture of Sakai, includes the Sen no Rikyu Cha-no-yu (Tea Ceremony) Museum and the Tea Ceremony Experience Rooms.

Kurumi Mochi (wrapped rice cake)

Traditional Japanese sweets from the Muromachi Period

Kurumi Mochi is a traditional Japanese confectionery born in the Muromachi Period, when Sakai prospered as a port city that traded with China. The name "kurumi-mochi" means "wrapped rice cake," as it consists of mochi wrapped in bean paste. During the Meiji

Period, people ate kurumi-mochi served over shaved ice, and this has become a famous summer treat for the people of Sakai



Welcome to Sambo Plant!

About Sambo Plant

The Sambo Plant manufactures and sells a variety of wrought copper products, such as strips (coiled copper), plates, and rods made from copper and copper alloys. The plant holds a No.1 share in the domestic production of wrought copper products. Through its high-quality manufacturing, the plant supports all fields of our life, including automobiles, ships, electricity, telecommunications, precision equipment, buildings, and daily necessities.



Hot rolling mill

A 300 mm thick block of copper is heated to 800°C. stretched into a 15 mm thin sheet with a roller, and then coiled.



Three years ago, an educational dojo consisting of a Hazard Experience Dojo, a SPM*-Maintenance Dojo, and Training Dojo was established for promoting safety and health activities and worksite improvements. The Training Dojo contains exercise equipment that employees can use to build muscle. *Sambo Productive Maintenance

Sambo Plant's TPM activities (voluntary maintenance activities)



12



ECO BRASS, a lead-free brass that is friendly to both human health and the environment, is used for water meters. CLEANBRIGHT, a copper alloy that further improves the sterilizing properties of copper and resists discoloration, is used for door handles in hospitals and other facilities. WNS7, white nickel silver, which is used for house and car keys, is also manufactured in this plant.



Direct and indirect extrusion machines

A heated cylindrical block of copper is inserted into the extrusion machine. A 2 to 12 m bar is extruded with great force.





Kim Jae-won

Rock Tools Group, Sales Div., **MMC RYOTEC Corporation**

Serving customers around the world with knowledge learned in Korea and Japan

I majored in mineral resource and energy engineering at a university in South Korea, and I became interested in mine development when I participated in a contest to estimate the economic value of mines. Although no new mines are currently being developed in Japan, mining technologies have evolved and are being used all around the world. So, I decided to study at a Japanese graduate school and researched AI and ICT technologies used in mine development. Afterwards, I wanted a job in the field of mine development, so I joined Mitsubishi Materials. I currently belong to the Metalworking Solutions Company, which manufactures and sells cemented carbide tools, and I am in charge of sales for North America of DIAEDGE Rock Tools (Rock Tools), cemented carbide construction tools used for drilling holes in hard bedrock during excavations of mines, tunnels, and wells, at MMC RYOTEC, a group company of Mitsubishi Materials. About 80% of our construction tools are shipped overseas, with North America accounting for 40% of those shipments. Last year, it was very difficult to book ships and containers as exports to North America increased in all industries due to the recovery from the COVID-19 pandemic and the impact of the strong dollar. However, through global teamwork with the production facility in Thailand, the sales company in the U.S., and MMC RYOTEC, we were able to create a precise

shipping schedule and earn the trust

of our customers by meeting delivery

deadlines.

Although many of our business meetings were previously conducted online due to travel restrictions imposed by the COVID-19 pandemic, this year we have finally gotten to visit our customers face-to-face at mines, guarries, and water well drilling sites. We build and maintain stable relationships with our customers by placing importance on after-sales service and providing rapid response and next solutions. Such engagement has been well received, and we were able to hear real voices of customers that they are glad they chose DIAEDGE.

Promoting technologies and products that contribute to the building of a recycling-oriented society

prosperous and recycling-oriented society. Much of North America's those water wells. Groundwater to the construction of heat pipes the earth. Geothermal heat is low-

(Left) The Metalworking Solutions Company values global teamwork.

(Right) We sometimes take customers on tours of the Rock Tools Plant to show them our products and facilities.



My work contributes to building a drinking water comes from wells, and Rock Tools are essential for digging pumped up from the wells is not only used for drinking water, but also for agriculture and livestock, supporting people's lives. Rock Tools also contribute that exploit the geothermal heat of temperature thermal energy about 10 m to 15 m below the ground's surface. The subsurface temperature, which is relatively constant throughout the year, is cool during the summer and warm in the winter compared to the air outside. We can take advantage of these differences in temperature for efficient cooling/heating, and geothermal heat is

drawing attention as a viable renewable energy solution. There are many ways in which our Rock Tools can contribute to creating a recycling-oriented society, so I find it very rewarding.

A company where diverse employees can demonstrate their abilities

Perhaps because our Group operates globally and many of our employees have been exposed to diverse cultures overseas, I think there is an openminded culture that embraces diversity. Although there are not many foreign employees at my current workplace, I feel that all employees are fully demonstrating their strengths.

Our Group is conducting various communication measures to create an organization in which employees can maximize their individual strengths to realize the company's Mission. As part of the program, "reverse mentoring," in which junior employees offer mentorship to managers, was introduced in 2021. I was only in my second year with the company when they were looking for the first group of participants, but I volunteered to communicate with the management and learn from them. Through the exchange of ideas with management and other mentors, my motivation to work for our Group was greatly enhanced.

In the future, I would like to work overseas as a sales representative to respond to the changes and needs of the global market and enrich the world through our Group's products and technologies. I hope to play an active role on the global stage as a bridge between Japan and the world.







The Power of Materials Builds Society

Aerospace

Chromium zirconium copper, a copper alloy that can withstand harsh environments

Many countries are developing space programs in order to seek undiscovered possibilities and promote human development. A copper alloy called chromium zirconium copper, which maintains the conductivity of copper but has high heat resistance, is used for rocket parts that go to space, a harsh environment. However, producing it is difficult, and there are only a few companies in the world that can stably provide the material. Mitsubishi Materials has succeeded in mass production of highpurity chromium zirconium copper and has been highly evaluated by customers around the world for a long time.

Recently, there has been a surge in the number of private companies entering into rocket development, so the frequency of rocket launches is increasing. The demand for rocket parts is also on the rise, and so as to reduce costs, chromium zirconium copper is drawing attention, which has strength for repeated use for engine parts. We will continue to fulfill customer expectations by stably providing highquality chromium zirconium copper.

PICK UP

Chromium zirconium copper cakes and billets

Chromium zirconium copper is used in a wide range of fields that require high strength, including automobiles, machinery, molds, iron and steel, heavy electric machinery, home appliances, aircrafts, and ships, in addition to rocket parts. Our company widely provides the copper in the shape of cast cakes and billets.

The Secrets of Materials



Exploring the "secrets" of materials and technologies Mitsubishi Materials has developed!

SOZAI FILE NO.4

What type of technology is **CO2decomposition and recycling technology**

With efforts to reduce the carbon dioxide (CO₂) underway around the world, wouldn't it be wonderful if we could decompose CO₂ to make new materials? In this issue, we will introduce the CO₂ decomposition and recycling technology that Mitsubishi Materials is developing.



an expert on materials **Dr. Materials** A doctor who loves materials devoted to research at a Mitsubishi

Materials lab

CO2changes into nanocarbon! Hydrogen is also created!

Effective utilization of carbon dioxide is an area that many companies are researching. Among them, Mitsubishi Materials' technology is able to produce nanocarbon and hydrogen by using an inexpensive reducing agent (powdery metal oxide) which is activated by hydrogen gas. Each of these two materials has the potential to be used in a variety of applications.



The process is also eco-friendly!

The reducing agent can be used repeatedly, and since the temperature required for decomposition is low, we believe that it would be possible to use factory exhaust heat or renewable energy.

Areas of applications



Power plants, factories, etc.

This technology could be applied to facilities that emit large amounts of CO_2 , such as thermal power plants, factories, and waste incineration facilities, to reduce CO_2 emissions.



As a new carbon material

Nano carbon materials can potentially be used as raw materials for tires and rubber products, colorants for inks and paints, and conductive materials. The road to solving global warming is a long one. We must all work together to reduce CO₂ emissions.

 \odot



Joint Development of Lithium-Ion Battery Recycling Technology

Mitsubishi Materials, in collaboration with Envipro Holdings and VOLTA, has begun developing a hydrometallurgical technology to recover and refine the lithium, cobalt, and nickel in the black

mass produced during the recycling process of lithium ion batteries (LIBs), on the premise of commercialization. There are concerns that the minor metals used in LIBs will be in short supply in the near future, so their recycling is attracting attention. We will accelerate the development by combining the respectively cultivated knowhow and hydrometallurgical technology to contribute to the establishment of an integrated recycling system from processing to materials supply ofLIBs



At the joint press conference held in December From left: Nobuhiro Takayanagi, Managing Executive Officer, Mitsubishi Materials; Tomikazu Sano, Representative Director, Envipro Holdings; Kenta Imai, President, VOLTA

Metalworking Solutions Business Website Redesigned – Member Sign-up Function Added to Enhance Customer Contacts –

Mitsubishi Materials Corporation has, for the first time in seven years, redesigned the website of its Metalworking Solutions business, which manufactures and sells cemented carbide tools, and added a new member sign-up function. As part of the DX strategy being promoted company-wide, the Metalworking Solutions



business has positioned DX promotion as a pillar for strengthening its business competitiveness and aims to enhance customer contacts and increase the added value of its services.

Additionally, in November, we exhibited at JIMTOF2022, Japan's largest machine tool fair, where we highlighted our commitment to "helping customers succeed by solving their problems through our solutions (products and services)" by using machining videos and setting up a technical consultation corner.

Commenced Investigation on the Commercialization of Dental Checkup Services for Health Insurance Operators

Mitsubishi Materials, together with Japan Dental Hygiene Association Corporation, has commenced an investigation of Smart Dental Checkup™, a cloud-based dental checkup service for health insurance operators, with a view to its commercialization. This is a service that performs diagnosis by digitizing the inside of the mouths of the examinees



Smart Dental Checkup™

and that is intended for dental checkups conducted on groups such as workplaces. It will enable examinees to zoom in, zoom out, and rotate 3D models of their teeth and gums on their smartphones so they can see every corner of their mouth, which is difficult to see directly. This service business is our first full-scale initiative in the medical field. We will carry out our investigation with the goal of commercializing the system by the end of fiscal 2024 and early realization of annual sales of 5 billion yen.

MMDX Company-wide Digitization Strategy Moves to the New "MMDX 2.0" Stage

Mitsubishi Materials Corporation, with the aim of further advancing and deepening its MMDX digitization strategy in progress since 2020, has decided to carry out a new phase of activities as "MMDX 2.0" from the second half of fiscal 2023. To further accelerate the



promotion of DX in the manufacturing field and integrate it with the smart factory and other measures that we have been working on up to now and to steadily implement existing themes, we will reorganize the themes and strengthen the system. Through "MMDX 2.0," we will achieve management reform and implement various initiatives for realizing our ideal form with the aim of evolving into a competitive corporate group.

*MMDX: Mitsubishi Materials Digital Business Transformation

Received a Bronze Award in the PRIDE Index 2022

Mitsubishi Materials Corporation has received a bronze award in the PRIDE Index 2022, which defines indicators for evaluating a company's commitment to LGBTQ+ and other sexual minorities. This evaluation index was developed for the first time in Japan in 2016 by "work with Pride," a voluntary organization that aims to create LGBTQ+-friendly workplaces in Japan beyond the framework



of companies and organizations. Our LGBTQ+ initiatives include the establishment of a consultation service related to sexual orientation and gender identity, training on basic knowledge related to LGBTQ+, and the inclusion of "other" in addition to "male" and "female" in the gender field on the entry form for employee recruitment selection.

Accelerated Communication through "My Personal Mission Campaign" and "Lending Smartphones to All Employees"

Mitsubishi Materials has set forth its Mission for 2030 to 2050 to contribute to the building of a "prosperous," "recycling-oriented," and "decarbonized" society, and we are carrying out various initiatives to encourage each employee to take



ownership of the comany's Mission as their own. As one of these initiatives, we conducted the "My Personal Mission Campaign," in which each employee shares their missions, from the end of September to the end of November. Additionally, in October, we began lending smartphones to employees at manufacturing sites who previously did not have devices in an effort to further invigorate communication.



Please take part in the WITH MATERIALS survey

We would love to hear your honest thoughts and opinions about this issue of "WITH MATERIALS" and what you would like to see covered in the future.



Hayakita Forest, one of our Materials Forests (Abira-cho, Yufutsu-gun, Hokkaido)

With Horses

Have you ever caught sight of animals in a forest? Many of them are wild animals who make their habitats there. In the Materials Forests that Mitsubishi Materials owns, there are mammals such as foxes and deer, birds such as woodpeckers, and frogs and fish in the rivers.

In the past, cows, horses, and other animals were domesticated in village forests in Japan. In nearby forests, you could often see horses carrying logs. Today, most of these roles have been taken over by heavy machinery, but some of our forests have introduced wood production using horses.

Horses can't carry a lot of logs at once compared with heavy machinery. On the other hand, they do less damage to the soil, so this method has a smaller impact on the other animals and plants that live in our forests and has a smaller environmental burden. Furthermore, the horses working in our forests also appear in local community events, and they are invaluable for making people feel at ease and putting smiles on their faces.