Social

Materiality 2 Provide Advanced Materials That Support Lives and Lifestyles

The excellent properties of the major base metal of copper and a variety of minor and precious metals have supported the evolution of electronic devices. The JX Nippon Mining & Metals Group continues to pursue technical rationality and efficiency, as well as make improvements in product quality and properties of these materials, so we can rapidly offer society products and technologies supporting the coming data society and IoT/AI society.

Developing Advanced Materials
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Promoting Open Innovation
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Building a Development Framework and Fostering Development Personnel
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Efforts to Cultivate the Next Generation
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KPIs and Progress

Assessment: ☺ Achieved/Steady Progress ☹ Not Achieved

KPI	Fiscal 2021 Results/Progress	Assessment
Develop advanced materials needed by the IoT/AI society	In order to capture growing demand, we have announced a series of production capacity expansion plans, including the construction of new plants and site acquisition, as well as measures to strengthen our supply chain. Continuing from the previous fiscal year, we have promoted open innovation through collaboration with companies and universities to develop advanced materials needed by the IoT/AI society.	☺
Build a framework to support technology-based management	With the goal of continuously generating innovative technologies and products for technology-based management, we have built a framework for development and worked to foster development personnel to generate new innovations and diversify human resources.	☺

Developing Advanced Materials

In order to contribute to the development of a sustainable society, the Group relentlessly pursues innovation by advancing and utilizing core technologies accumulated to date, and through co-creation with outside resources.

WEB JX Nippon Mining & Metals' Core Technologies
https://www.jx-nmm.com/english/rd_sp/core_tech/

Two New Plants in Hitachi City Expanding Production Capacity of Advanced Materials

The balance of supply and demand for advanced materials such as sputtering targets for semiconductors and treated rolled copper foil has been tight in recent years, making it an urgent issue to build a supply system that can fulfill strong market demand. Under these circumstances, we have decided to construct two new plants in Hitachi City, Ibaraki Prefecture, to expand our production capacity of advanced materials.

This will increase our capacity for sputtering targets for semiconductors by a total of 32 billion yen, or approximately 80% versus fiscal year 2020. In addition to strengthening existing sites, we plan to invest approximately 14 billion yen to construct a new plant in the HITACHI HOKUBU Industrial Park to handle melting and rolling processes.

For treated rolled copper foil, we plan to establish a new plant in the Shirogane district, to be part of the Hitachi Works, with a total cost of 16 billion yen. Until now, the Hitachi Works has been handling surface treatment as the final process. With the production line for the rolling process also being installed in the new plant, production capacity will increase by approximately 25% versus fiscal year 2020.

Rendering of the New Hitachi-kita Factory (tentative name) (scheduled to start operation in the second half of fiscal 2023)

Image of the New Hitachi Factory (tentative name) (scheduled to start operation in the first half of fiscal 2024)

Acquisition of a Building Site for Expansion of Production Capacity in Arizona, U.S.

Accelerated moves towards digital transformation and decarbonization are currently driving rapid expansion in the semiconductor industry. As part of the trend, leading semiconductor manufacturers, among the Company's major customers, are planning successive investments in the United States. The Company had already established JX Nippon Mining & Metals USA, Inc. in Arizona, which is a U.S. semiconductor industry hub, and it is necessary to expand production capacity further to fulfill customer needs.

Therefore, in March 2022 we acquired approximately 260,000 m^2 of land, roughly six times the area of the existing site, in Arizona. Construction of a new sputtering target plant is planned to begin in the second half of fiscal year 2022, with operations to commence in fiscal year 2024 or onward. As a result, production capacity in the U.S. is expected to increase by 2.5 times, compared to the previous capacity. We will also utilize the site not only as a base for production of sputtering targets for semiconductors, but also as a site for new business development, and we aim to make it the center of our business in the advanced materials field in the US.

Rendering of the new base

Strengthening the Tantalum Target Business Supply Chain

In April 2022, the Company made tantalum and niobium smelter Tokyo Denkai Co., Ltd. into a wholly owned subsidiary. Tokyo Denkai was founded in 1950, and possesses outstanding technology and production capabilities in the fields of smelting high-melting-point metals. Today, its main business is producing ingots for tantalum sputtering targets, which are used as a protective material for semiconductor interconnects.

Tokyo Denkai procured high-purity tantalum powder from TANIOBIS, a Group company, and used it as raw material to smelt ingots, which were then sold to our Isohara Works. Since April 2021, we had invested in Tokyo Denkai together with Mercuria Investment Co., Ltd. and through this new acquisition of shares, we have further strengthened our partnership. We will further strengthen our supply chain in the tantalum sputtering target business and aim to create synergies with the JX Nippon Mining & Metals Group in the minor metal area in general, with a focus on niobium.

Established the Crystalline Material Business Promotion Office

It is anticipated that demand for compound semiconductor substrates used in optical devices and other high-functionality crystalline materials will grow in a variety of fields, including light receiving and emitting devices, which are essential amid the significant increase in data communications and the practical application of advanced sensing technology in the 6G era, and power semiconductors, critical for achieving a decarbonized society. Moreover, the Company has the advantage of technologies in the crystalline materials field such as high-purity refining, in which it excels.

Against this backdrop, in October 2021, we established the Crystalline Material Business Promotion Office within the Advanced Technology & Strategy Department, Technology Group in anticipation of future business expansion in this field. With this new organization that will be centrally responsible for supporting the planning and execution of expansion strategies for existing businesses and promoting the development of next-generation materials, we will aggressively promote the development of next-generation crystalline materials.

Compound semiconductor substrates (indium phosphide, cadmium zinc telluride)

Exhibited at the 8th Metal Japan (highly-functional metal expo)

We presented an exhibit at the 8th Highly-functional Metal Expo (Metal Japan) held at Makuhari Messe (Chiba Prefecture) from December 8 to 10, 2021. Our exhibit presented metallic and ceramic materials, including various high-performance copper alloys and various developed products, centered on a series of themes including metal powder for additive manufacturing and controlling heat. In addition, we once again prepared a special website, as in the previous year, to provide easy-to-understand information on products and technologies that could not be presented in panels.

At our exhibition booth

WEB Exhibition Special Website
https://nmmjx-dc.com/en/

Received the EPIC Distinguished Supplier Award from Intel Corporation

The award recognizes a consistent level of strong performance across all performance criteria. To qualify, suppliers must exceed expectations, meet aggressive performance goals, and score 80 percent or higher in performance assessments throughout the year. In 2022, only 26 suppliers in the Intel supply chain network earned this award.

“As one of only 26 Distinguished Supplier Award recipients across the Intel global supply chain, JX Nippon Mining & Metals Corporation has been crucial to Intel’s success while offering agility and flexibility during the ongoing volatile supply chain environment,” said Keyvan Esfarjani, EVP and Chief Global Operations Officer at Intel. “They have provided exceptional collaboration and commitment toward safety, quality, diversity & inclusion, and exceeded our expectations in support of Intel’s supply chain operational excellence. Earning this award speaks to their dedication to Intel values and their partnership.”

Promoting Open Innovation

We are promoting co-creation in a variety of formats, including collaboration with unique technologies held by Group companies, joint research with universities and other research institutions, and partnerships with external companies. These activities have the aim of building a system capable of generating new technologies and value.

Additional Investment in Novel Crystal Technology, Inc., a Developer of Gallium Oxide Crystals

Novel Crystal Technology, Inc. is a start-up engaged in development aimed at commercializing gallium oxide crystals, which are expected to be adopted in future generations of power semiconductor devices. The Company first took a capital stake in Novel Crystal Technology in June 2020, and has since collaborated in efforts such as development of raw materials. Novel Crystal Technology has made a new third-party allocation of shares aimed at procuring funds to augment its manufacturing capabilities with a view to product development of high voltage diodes scheduled for this year. The Company has taken part of this allocation and increased its stake in Novel Crystal Technology.

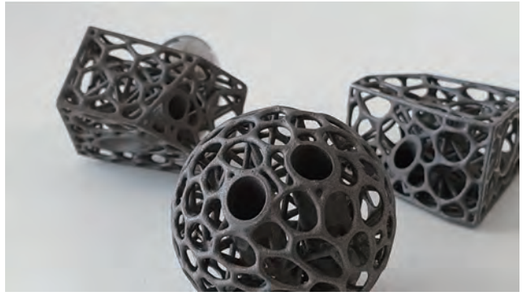
As a material for use in future generations of power semiconductor devices, gallium oxide will enable innovation in the design of power sources for electric vehicles and other applications and of electric power transmission systems, and is expected to contribute to effective energy use. The Company and Novel Crystal Technology will combine their technologies and knowledge to contribute to swift commercialization of this material.

Gallium oxide 100mm epitaxial wafer/substrate

Alloyed Develops a Titanium Alloy Artificial Bone

U.K.-based Alloyed Limited, in which the Company has a stake, is a start-up from Oxford University whose business includes designing alloys and molds for metal additive manufacturing. As one application for metal additive manufacturing, Alloyed is developing medical implants (artificial bones) in cooperation with the Company and Group member TANIOBIS.

Alloyed has now successfully designed and manufactured ankle joint implants using metal additive manufacturing, and the first surgery using these implants was performed in September 2021. Alloyed intends to increase the use of its ankle joint implants in the future, and will also expand development into the design of implants for other areas of the body to assist those suffering from bone cancer.



Ankle implants (artificial bones) designed and formed using metal additive manufacturing

Final Selection Carried Out for Accelerator Program

On March 29, 2022, the Company, in collaboration with France-based Agorize, conducted the final selection for the Innovation Challenge for the Next Generation 2021-2022 accelerator program, with the aim of creating new businesses. The program received a total of 65 proposals for a rich variety of ideas from start-ups and the academic community around the world. In carrying out the final selection of the seven companies shortlisted after interviews, we selected the top three companies based on evaluations from the perspectives of technology advancement, attractiveness of the business, and synergy with JX Nippon Mining & Metals Group’s business. In addition, the winner of the Audience Prize was selected by votes from Company employees. Going forward, we will explore the potential for a wide range of partnerships with the winning companies, including joint development, funding assistance, capital alliances, provision of materials, and provision of sales channels.

Selection Results for the Accelerator Program

Rank	Company name	Location	Business plan
Grand Prize	Additive Flow	United Kingdom	Multi-scale design optimization software for metal additive manufacturing
Runner-Up	PrintCB	Israel	Copper ink for printed electronics
Second Runner-Up	Outsense Inc.	Japan	Modeling new shapes of copper foil using automatic shape generation and simple analysis tools
Audience Prize			

The final selection meeting (held online)

Invested in an Israeli Battery Materials Development Company

In February 2022, we invested and took a stake in Addionics Limited, an Israeli company that develops smart 3D electrodes used in lithium-ion batteries. Addionics is a start-up developing 3D electrodes for lithium-ion batteries, and is using AI technology to develop 3D-shaped electrodes with porous structures. Compared to ordinary electrodes, 3D electrodes enable increased loading of active material, which improves energy density while reducing battery internal resistance. For this reason, they are expected to contribute to extended EV driving range, miniaturization of IoT devices, and reduced charging time.

The Company's investment will provide a springboard to build a stronger relationship with Addionics, and we will move forward with business development related to battery materials, while considering future collaboration with Addionics. We also believe that the investment will provide an opportunity to build networks with outstanding start-ups and academic institutions in Israel, which is a hub for tech companies. This will lead to generation of new business.

Established a Material and Technology Cooperative Research Laboratory with the National Institute of Advanced Industrial Science and Technology

In November 2021, we established the JX Metals-AIST Advanced Material and Technology for Future Society Cooperative Research Laboratory. By merging and further developing materials development technologies and manufacturing process technologies possessed by AIST and JX Metals, the Cooperative Research Laboratory aims to achieve rapid practical deployment of materials for highly functional next-generation devices. To establish platform technologies for next-generation wireless telecommunications, research will target development of new manufacturing methods for flexible circuit boards, technologies for bonding copper foil and resin, and assessment of high-frequency conductivity of copper foil and materials bonding copper foil and resin. The laboratory will also go beyond these fields to develop materials and technologies in various domains relating to nonferrous metals.

JX Metals President Murayama Seiichi (left) and AIST President Ishimura Kazuhiko (right)

Invested in Venture Capital Fund

The Company decided to invest 500 million yen in the MIRAI SOZO 2 Limited Partnership venture capital fund managed by Innovations and Future Creation Inc. Innovations and Future Creation is a venture capital firm that works with the Tokyo Institute of Technology. As well as investing in start-ups at the seed stage*1 and early stage*2 in fields such as materials, chemicals, semiconductors, IoT, space, and robotics, the firm also provides management support to help start-ups to move to the next stage. To date the fund has invested in 31 companies, several of which are now publicly listed.

Traditionally, we have invested in and collaborated with start-ups mostly at the early stage. However, in order to further broaden the scope of our efforts, we decided to invest in venture capital funds. Through this investment, we will support the commercialization of outstanding research produced by the Tokyo Institute of Technology, and develop collaborations built on this research.

*1 Seed stage: Generally denotes a start-up around the time of its establishment, when it is solidifying the ideas and concepts of its business
*2 Early stage: Generally refers to a start-up that has passed the seed stage and entered the development stage

Exchange meeting with Innovations and Future Creation

Activities of the JX Metals Endowed Unit (Phase 2 to Phase 3)

Despite growing needs for a stable supply of nonferrous metal materials in recent years, the pool of researchers and engineers in Japan working in fields related to smelting, refining, and recycling nonferrous metals has been on the decline. In response to this situation, JX Nippon Mining & Metals, in collaboration with the Institute of Industrial Science, The University of Tokyo, launched the Endowed Research Unit for Nonferrous Metal Resource Recovery Engineering (JX Metals Endowed Unit) in 2012. The purpose of this organization is to develop new environmentally friendly recycling technologies for nonferrous metals while also developing the human resources responsible for the work in this field.

To prevent the spread of COVID-19, major activities in fiscal 2021 included symposiums held online, like in the previous year. These symposiums were attended by many people from Japan and abroad.

Against this backdrop, the unit began Phase 3 (five years) in January 2022. In Phase 3, we plan to further develop our activities to promote understanding and awareness of the importance and future of the nonferrous metals industry, as well as focus on activities for realizing the SDGs and for STEAM education* to nurture the next generation.

* STEAM education: An educational concept that combines the initial letters of five words: Science, Technology, Engineering, Art, and Mathematics. This concept aims to develop logical thinking and creative skills that lead to problem solving in the real world

At the press conference for the start of Phase 3
From left to right: Executive Officer Suwabe, Senior Executive Officer Tani, Project Professor Kurokawa, Project Professor Tokoro, Deputy Chief Executive Officer Sugawara, Director General and Project Professor Okabe, Project Professor Sugano, Project Lecturer Ouchi

Received 2022 Shokumon Award from The University of Tokyo

In recognition of these activities at the JX Metals Endowed Unit, we received the 2022 Shokumon Award* from the University of Tokyo. The University of Tokyo's Shokumon Award was established in 2002 to recognize individuals, corporations, and other organizations that have made major contributions to the growth of The University of Tokyo, either through volunteer work, or endowed courses and research centers. The award was given in recognition of our outstanding contributions to creating a center for research, exchange, and education that has attracted outstanding human resources and advanced information from all over the world for many years.

* Shokumon is the name of the castle gate in the capital of the ancient Chinese state Qi (now Shandong Province) during the nation's civil war era (403-221 B.C.). It is derived from a legend that the king of Qi treated scholars well, which led to the gathering of the wisest minds in the capital of Qi and the flourishing of academic activities.

Presentation of the Shokumon Award plaque (Prof. Fujii Teruo, President of the University of Tokyo (left) and President Murayama Seiichi, JX Nippon Mining & Metals (right))

Members (Fiscal 2021) * Positions and other information are as of fiscal 2021

Project Professor Okabe Toru H.
Director General, Institute of Industrial Science, The University of Tokyo
Professor, Integrated Research Center for Sustainable Energy and Materials, The University of Tokyo

Project Professor Tokoro Chiharu
Professor, Faculty of Science and Engineering, Waseda University
Professor, Graduate School of Engineering, The University of Tokyo
Project Professor, Institute of Industrial Science, The University of Tokyo

Project Professor Kurokawa Harumasa
Project Professor, Institute of Industrial Science, The University of Tokyo

Project Professor Sugano Tomoko
Professor, Institute of Industrial Science and Deputy Director General, Division of University Corporate Relations, The University of Tokyo
Deputy Director, Public Relations Strategic Planning Office, Division for Strategic Public Relations, The University of Tokyo
Patent Attorney

Project Lecturer Ouchi Takanari
Lecturer, Institute of Industrial Science, The University of Tokyo
Lecturer, Integrated Research Center for Sustainable Energy and Materials, The University of Tokyo

Main Activities in Fiscal 2021 * Positions and other information are as of fiscal 2021

▶ July 2021

The 96th Rare Metal Workshop: "General Discussion: How Should LIB Recycling Be?"

▶ November 2021

The Science Council of Japan Open Symposium: "Why SDGs? - SDGs and Carbon Neutrality in Resource and Material Circulation-" (Co-sponsor)

JX Nippon Mining & Metals Director & Senior Executive Officer Yasuda Yutaka gave a lecture titled "Current Status and Prospects of Nonferrous Metals Companies' Contribution to the SDGs: SDGs in Resource and Material Circulation," where he introduced our initiatives

▶ January 2022

Press conference for Commencement of the Third Period

Held the 9th Precious Metals Symposium: "Frontier of Extraction and Recycling Technology for Precious Metals," for which this unit is a joint organizer, in conjunction with the press conference

Building a Development Framework and Fostering Development Personnel

The Group is working to build a framework for the continuous generation of innovative technologies and products, such as decarbonization technologies, by promoting DX support in the areas of production and development, developing platforms for the creation of new development ideas, and strengthening development process management. In addition, we are fostering personnel responsible for technology development and technology-based business development.

Strengthening Internal Processes for New Business and Technology Development

We have introduced the Stage-Gate Process as our management system for business development. In addition, we practice Idea Seed Bank activities as a platform for generating topics and ideas. These efforts are handled by the Advanced Technology & Strategy Department, a department dedicated to the planning and formulation of Group-wide technology strategies.

● Introduction of the Stage-Gate Process

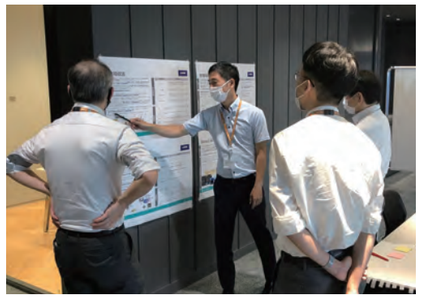
In promoting new development themes, we have introduced the Stage-Gate Process, which divides the development process into multiple stages. We use Stage-Gate Process for applications from discovery of medium-to long-term topics to commercialization for new products and technologies. The effective functioning of this Stage-Gate Process promotes activities that continuously generate innovative technologies and products, such as decarbonization technologies.

● Development of Platforms for Generating Ideas

The Idea Seed Bank (ISB), one of the Advanced Technology & Strategy Department's initiatives, is a platform to encourage employees to generate and cultivate ideas. It provides support for the conception of ideas, support for internal reviews, and discussions among members. It also offers a forum for employees from different departments and sites can interact with each other, providing them stimulus to give shape to their own ideas. One of these ideas generated at the ISB has even been approved as a development theme for one of our divisions in August 2021. The scope was expanded to the corporate departments and the Tantalum and Niobium Division in fiscal 2021, and to all divisions in fiscal 2022.

Internal Training Held by the Advanced Technology & Strategy Department

In addition to human resource development through the Idea Seed Bank, our Advanced Technology & Strategy Department holds cross-organizational study groups to help each individual member of the Group understand the Company and products outside of their responsibility, and to promote cooperation between divisions beyond their own. At these cross-organizational study groups, all employees learn about each division's business lines, products, and services. Through active Q&A and discussion, each employee gains a better understanding of the Group, which in turn leads to wider communication with external stakeholders. Through these efforts, we are developing human resources who can play an active role in finding potential co-creation partners, exploring new development themes, and further expanding existing businesses.



A discussion at a workshop held by the Advanced Technology & Strategy Department

Column

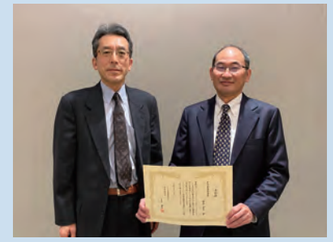
Intellectual Property Initiatives

Intellectual property is an important asset for the technology-based company that we, the JX Nippon Mining & Metals Group, aim to be. Our intellectual property, technology, and business department work together to strategically protect and utilize intellectual property with the goal of maintaining our competitiveness and a stable supply of materials. We also respect the valid intellectual property of other companies and respond appropriately to the risk of intellectual property infringement.

Initiatives for Promoting Invention

In accordance with the Patent Act, the Group has established the Regulations Concerning Handling of Employee Inventions. In addition to incentives at the time of application and registration, we have established our own unique system to award inventors of profitable patents and inventors of outstanding inventions to encourage development and invention and promote activities as a technology-based company.

In fiscal 2021, nine inventions were eligible for awards, including improvements in sputtering target quality, increased copper foil productivity, and the development of a valuable metal recovery process. In addition, we also recognize inventions that are kept secret as expertise, as well as patents.



Fiscal 2021 award ceremony

Developing Intellectual Property Human Resources

The development of intellectual property human resources is important to carry out our intellectual property strategy. In the interest of appropriate acquisition, protection, and utilization of intellectual property and management of intellectual property risks, the Group provides all employees, including clerical staff, with intellectual property education based on a systematic program and using its own teaching materials, as shown on the right.

In addition, in order to address intellectual property work that is becoming more sophisticated every year, the Intellectual Property Department encourages the acquisition of patent attorney qualifications and conducts study groups within the department to further improve practical skills and enhance expertise.

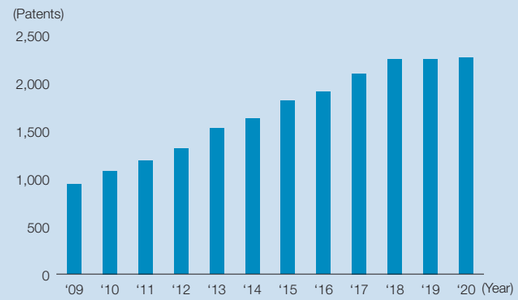
■ Educational programs implemented in FY2021

- Education by job function enabling employees to acquire necessary knowledge in accordance with intellectual property skills
  Carried out multiple programs, including new employee education, third-year education, and fundamental education for technical employees
- Specialized intellectual property training by external lecturers
  Carried out programs such as seminars on drafting strong patent specifications
- Workshops on the IP landscape
  Carried out workshops on simulated IP landscapes with marketing and intellectual property staff

Status of Held Patent Rights

Our Group is actively promoting research and development to become a technology-based company. The intellectual property department collaborates with the business and research department to appropriately protect and utilize inventions generated in the course of research and development as intellectual property, thereby contributing to our businesses.

Number of Patents Held in Japan



Reference

Special Feature 3: Further Accelerating our Digital Transformation (DX) Strategy > Promoting Strategic IP Strategies ⇒ Page 60
Activities Related to COVID-19 > Participation in the IP Open Access Declaration Against COVID-19 ⇒ Page 97

Efforts to Cultivate the Next Generation

In order to keep stability in securing and supplying irreplaceable nonferrous metal resources and materials, it is essential to develop human resources who can take on future challenges. Our Group provides young people, mainly from elementary school to high school, with opportunities to gain experience and hands-on practice in a variety of areas, and to learn about nonferrous metals.

Social Studies Field Trip Program for Elementary School Students

On February 6, 2022, we held the Getting to Know the Copper Around Us program as a social studies field trip program for elementary school students. This program was hosted by the Shiba Regional City Office in Minato City for the second consecutive year. Three parent and child groups totaling nine participants joined the program. Participants took part in quizzes and watched videos about copper, learning about the characteristics of copper and how it is useful in our lives. They also participated in an experiment on cleaning a 10-yen coin with seasonings and an experiment on heat conduction using different types of metal rods.

Participating elementary school students commented that the 10-yen coin experiment was fun and that they would like to try another experiment next time, while parents said that they learned a lot about copper through the experiment and that they are looking forward to next year's event. The positive attitudes displayed by the children toward the experiments and the enjoyable conversations they engaged in reaffirmed the importance of continuing to provide opportunities for interaction with the local community.

The program was held with thorough measures against the spread of COVID-19

Held the Rikochallenge Summer of 2021

We support the Rikochallenge (science and engineering challenge) program to help girls experience work in science and engineering, an initiative led by the Gender Equality Bureau of the Cabinet Office. Rikochallenge is an initiative aimed at supporting future career choices for female students interested in science and engineering fields. As part of this initiative, the Group has held plant tours and hands-on experiment sessions every year since 2015 (sessions were canceled in fiscal 2020 due to the COVID-19 pandemic).

In fiscal 2021, events were held for junior high students (male and female), and were limited to the Kurami Works (Kanagawa Prefecture) and the Saganoseki Smelter & Refinery (Oita Prefecture) of JX Metals & Smelting Co., Ltd. In addition to providing an opportunity to experience the unique sensations of being on-site at each location, we introduced the social contributions of copper and other nonferrous metals and thoughts from science and engineering employees about their work. Through these events, we will continue to communicate the role of nonferrous metals in supporting society and the possibilities that science and engineering jobs create.

Kurami Works (August 2, 2021)

Saganoseki Smelter & Refinery (August 2 and 10, 2021)

VOICE

Comments from a Rikochallenge Organizer

Students from nearby junior high schools toured our plant and conducted experiments such as electrorefining and solvent extraction. Many participants commented that the event sparked greater interest in science and science-related occupations. They expressed enjoyment in learning about the properties of copper and other nonferrous metals and actually experiencing these, making them like science even more. The content was designed to help students realize the fun of science through hands-on experience of what they have learned in class. For myself, I also enjoyed learning alongside the students on the organizing side.

JX Metals Smelting Co., Ltd. Administration Department (as of the event)
Natsuhara Miyu

University of Tokyo Faculty of Engineering Students Invited to Head Office Tour

In December 2021, 14 students from the University of Tokyo's Department of Systems Innovation, part of its Faculty of Engineering, along with Professor Tokoro Chiharu and Associate Professor Takaya Yutaro of the same department, were invited to visit our head office and attend a workshop. Through a tour of the showroom and a simulated experience of the Saganoseki Smelter & Refinery's operations using virtual reality (VR), participants learned about the processes by which copper and other nonferrous metal materials are provided to society and contribute to its development. In addition, a workshop was held on the theme of product development, where active discussions were held on the topic of what parts of daily life copper's antimicrobial properties can be utilized in. Many students who participated in the seminar commented that it gave them an understanding of how nonferrous metals are utilized in various fields.

Participants touring SQUARE LAB

Simulated experience of an operation site using VR

Popularizing STEAM Education

We have been a regular member of the Platform for Learning Innovation - Japan (PLIJ) since its establishment. PLIJ aims to be a groundbreaking organization that brings together industry, academia, government, and public education with a mission to accelerate innovation, primarily in elementary and secondary education, focused on the pillar of STEAM education. Through our membership in the PLIJ, we will continue our efforts to nurture the next generation for as many children as possible, and to help cultivate the future leaders of our society.

Providing Educational Content

We provide content on our website that allows children to learn about copper in the form of quizzes and games in order to increase the interest of the next generation in nonferrous metals.

● Webpage for Kids: What's Going on With Copper-kun?

Based on the three concepts of learning, having fun, and participating, this content allows children to learn about copper while having fun.

WEB What's Going on With Copper-kun? (Japanese only)
https://www.jx-nmm.com/copper/

WEB A quick and easy-to-understand story about copper (Japanese only)
https://www.jx-nmm.com/copper/profile/

● Webpage for Junior High and High School Students: Nonferrous Metals Creating the Future

While surprisingly few people have a firm grasp on the basics of nonferrous metals and its manufacturing process, this website presents the world of nonferrous metals in an easy-to-understand manner.

WEB Nonferrous Metals Creating the Future (Japanese only)
https://www.jx-nmm.com/future/

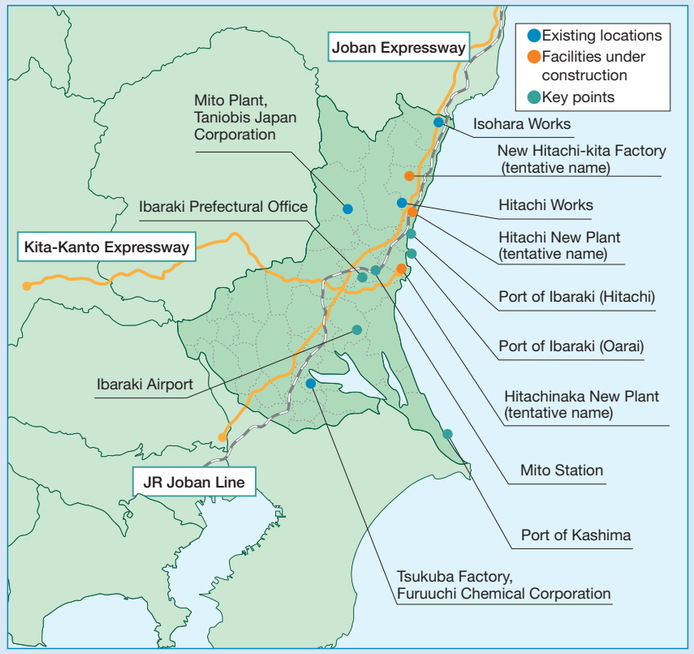
Column

Relationship between Ibaraki Prefecture and JX Nippon Mining & Metals Corporation

-Major new facility focusing on advanced materials-

Artist's impression of Hitachinaka New Plant (tentative name)

JX Nippon Mining & Metals Corporation traces its roots back to the start of operations at the Hitachi Mine in Hitachi, Ibaraki Prefecture, in 1905. Since then, we have contributed to the development of the city and industry of Hitachi by supplying copper resources. We continue to provide a stable supply of a variety of products to our customers around the world. Today, we have several production facilities in the prefecture. These include our main Hitachi Works, a combined facility for manufacturing and recycling advanced materials, and Isohara Works, where we manufacture materials used for semiconductors and flat panel displays. In addition, we are constructing three new facilities, including the Hitachinaka New Plant (tentative name), which is mentioned on the next page. We have a very close relationship with Ibaraki Prefecture, and the area is very important to our business.



Ibaraki Prefecture Basic Information

- **Prefectural Government Office:** Mito City
- **Population:** Approximately 2.85 million people (11th in Japan)
- **Area:** Approximately 6,097km² (24th in Japan)
- **Main rail connections:** JR Joban Line, JR Mito Line, Tsukuba Express, Kashima Rinkai Railway-Oarai Kashima Line, and Hitachinaka Kaihin Railway-Minato Line
- **Out-of-prefecture companies located in prefecture:** largest number of any Japanese prefecture
- **Professional sports teams:** Kashima Antlers (soccer), Mito HollyHock (soccer), and Ibaraki Robots (basketball)

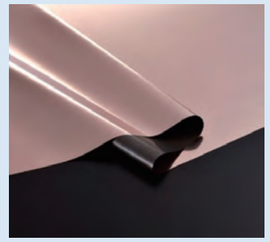
* Source: Ibaraki Prefecture official website

Large-scale new plant in Hitachinaka City under construction

In March 2022, we acquired a large site in Hitachinaka City for the construction of a new plant. In addition to being involved in existing areas of growth, such as sputtering targets for semiconductors, treated rolled copper foil, and high-performance copper alloys, the new plant will be a core center of our Group for new business related to advanced materials. Underlying the construction of the new plant is our desire to satisfy the highly anticipated growth in demand for our advanced materials that will come with ever-increasing global digitization and electrification. To that end, we fully intend to establish new manufacturing and R&D facilities here and expand our supply capacity.

The new plant will be our largest investment to date in advanced materials. It is scheduled to start operations in stages beginning in fiscal 2025, and it will contribute to the reliable supply of advanced materials, regional economic development, and job creation. In addition, the location is easily accessible from our existing plants in Ibaraki Prefecture and our Tokyo headquarters. This will allow us to further strengthen inter-group cooperation and build a more efficient operational structure.

Sputtering target for semiconductor



Treated rolled copper foil for smartphones and other devices

Contributing to the Community

Since our establishment, the JX Nippon Mining & Metals Group has always conducted business in the spirit of coexistence and with a desire to share our prosperity with the local community. So as we look ahead, with the construction of our new plants and the importance of reliable supply chains growing, we are promoting activities to further develop the region and increase our visibility.

One such specific initiative is becoming an official partner of Mito HollyHock, a soccer team in the Japan Professional Football League (J-League), in April 2022. In addition, we have made ourselves more visible in the local community by sponsoring the LuckyFM Green Festival, a music event organized by Ibaraki Broadcasting Corporation at the National Hitachi Seaside Park, and the Hitachinaka Festival, which is held at various locations in Hitachinaka City. We are also advertising on station billboards and on the outside of trains in the region. These events have also led to more contact among our facilities in the prefecture as well as increased employee motivation.

Joint press conference on the construction of the Hitachinaka New Plant (tentative name) (Left: Kazuhiko Oigawa, Ibaraki Prefecture Governor Right: Seiichi Murayama, Group President)

Mito HollyHock JX Nippon Mining & Metals Group "Thanks Match"

Sponsorship of firework display at LuckyFM Green Festival

In-prefecture advertising (Mito Station)

In-prefecture advertising (Kashima Rinkai Railway-Oarai Kashima Line)

Column

Joint course with Kyoto University Graduate School of Advanced Integrated Studies in Human Survivability (*Shishu-Kan*) toward achieving the SDGs.

What is Shishu-Kan?

It is a graduate school that offers a five-year integrated doctoral program to foster global leaders who are ready to take on the various challenges facing modern society. These challenges include climate change; natural disasters, regional conflicts; super-ageing societies; poverty; inequality; energy, food, and water issues; and harnessing artificial intelligence. The school is developing a unique curriculum that transcends the barriers between the humanities and sciences to nurture talented people with overarching views. (Note: *Shishu-Kan* is the Japanese acronym for this graduate school.)

On the basis of the Comprehensive Collaborative Research Promotion Agreement for Achievement of the SDGs signed in January 2020 between JX Nippon Mining & Metals and Shishu-Kan, the Joint Chair of Global Social Resilience for the Achievement of SDGs, was established in May of the same year. With central focus on the keyword “SDGs,” this program aims to identify, extract, and research issues in all domains and provide solutions to global issues related to the SDGs.

Four Areas of Activity

Program-Specific Professor Hashimoto Michio and Program-Specific Associate Professor Shimizu Mika, two Shishu-Kan professors, have been appointed to lead the joint course. Its first event (held online in May 2020), an online lecture held on May 2020, covered the program’s two faculty members’ research fields and content, with participation from our Company directors and employees. This lecture serves as the starting point for our work to advance the following four core activities from fiscal 2021 onward. (See table on right.)

Activity	Details
1. Metals Business Study Group	Company employees and Shishu-Kan students work together to study and plan solutions to various issues facing our business
2. Resilience Workshop	Workshops for Company employees on various resilience topics
3. SDGs Future Vision Study Group	Lectures by Shishu-Kan faculty members and research presentations and discussions by students in each of Shishu-Kan’s eight academic fields*.
4. Decarbonization Workshop	Discussion on net zero CO_2 emissions from the perspectives of both academia and business

* Humanities and Philosophy; Economics and Management; Law and Politics; Linguistics; Science and Engineering; Medical and Life Science; Informatics and Environmental Studies; and Art

Metals Business Study Group (Led by Program-Specific Professor Hashimoto Michio)

After a presentation giving an overview of the JX Nippon Mining & Metals business by our employees, Shishu-Kan faculty and students visited the Saganoseki Smelter & Refinery of JX Metals Smelting Co., Ltd., Hitachi Works, and Nippon Mining Museum. This was followed by a presentation from the vice president of our company on developing the nonferrous metals business in a way that achieves SDGs. After the presentation, our employees and Shishu-Kan students engaged in joint workgroups. Starting in fiscal 2021, presentations of the results of this joint work have been held. Shishu-Kan’s faculty members attend—including Shishu-Kan deans Professor Takara in 2021 and Professor Sekiyama in 2022—as well as our company president and other executives. In addition, they have engaged in active discussions. In fiscal 2022, eight students attended, including two international students, with some of the presentations given in English, making it a study group that embodies its diversity. Participation in the study group earned student’s academic credits at Shishu-Kan.

Presentation of results

Lecture at Shishu-Kan

Presentation Themes

- Analysis of nonferrous metal price trends using financial engineering, and utilization of mines post-closure
- Study of contributions to the local community in the Hitachi area
- HR strategy for 2050 (secure, train, and utilize talent; give back to society; and public relations)
- Hitachi Copper Museum Project (Proposal for renovation and improvement of Nippon Mining Museum)
- Establishment of new recycling systems and development of space mineral resources
- Opportunities to provide materials for healthcare industry
- Development of comprehensive SNS strategies

Resilience Workshop (Led by Program-Specific Associate Professor Shimizu Mika)

Program-Specific Associate Professor Shimizu Mika held series of workshops on resilience for our employees. By experiencing resilience thinking through workshops, employees were provided with opportunities to reflect their own insights and work styles. This way of thinking includes acting as a *middleman* in bringing about change and being able to think the whole and details in a continuum (as a metaphor, "*looking at the forest and trees in a continuum*"). The workshops have been held more than 15 times since fiscal 2021, being attended by a wide range of participants, from junior employees to newly appointed managerial staff.

In addition, Program-Specific Associate Professor Shimizu gave a lecture titled "To link is to live" to students from Saganoseki Elementary School and Saganoseki Junior High School in Oita City. These are two schools near the Saganoseki Smelter & Refinery of JX Metals Smelting Co., Ltd. To commemorate the 100th anniversary of the Saganoseki Smelter & Refinery in 2016, JX Nippon Mining & Metals and JX Metals Smelting began a painting and essay contest every three years for students from nearby elementary and junior high schools. this lecture provided an opportunity for students to receive inspiration and insights for working on their paintings or essays toward the third contest to be held this summer.

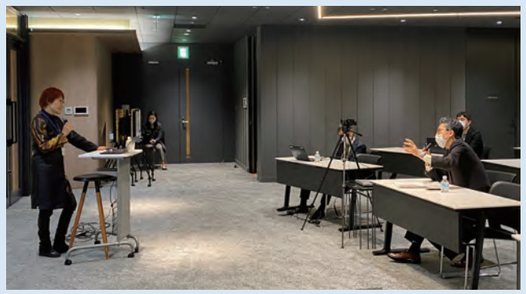
Workshop for new managerial staff

Lecture at Saganoseki Junior High School

SDGs Future Vision Study Group (Led by Shishu-Kan faculty)

Eight members of faculty gave special lectures to our board members and employees on cutting-edge trends in each of the eight academic fields covered by Shishu-Kan. Many employees participate in these sessions, giving them opportunities to encounter topics they would not normally come across in their regular work. It is also a chance to see things from different perspectives.

Eight Academic Fields	Lecture Themes
1. Informatics and Environmental Studies	Overview of Shishu-Kan and its Disaster Risk Research
2. Medical and Life Sciences	Preventing dementia from the perspective of research on intervention
3. Economics and Management	Sustainable development in developing countries and challenges related to making renewable energy available
4. Linguistics	Global human resources necessary going forward
5. Science and Engineering	Global issues from perspective of natural sciences and encouraging cross-disciplinary research
6. Humanities and Philosophy	Philosophy of attention in the information age and mindfulness and inherent wisdom of Buddhism
7. Law and Politics	Toward sustainability transformation (SX) and beyond ESG management
8. Art	Innovations in art



Lecture and Q&A session

Decarbonization Review Workshop (Led by Professor Dimiter Ialnazov)

Discussions were held from the perspectives of both academia and business on the fiscal 2050 net-zero CO_2 emissions goal of JX Nippon Mining & Metals. Members of the Carbon Free Project and our employees and JX Nippon Research Institute for Technology and Strategy Co., Ltd. participated in a lively discussion with faculty and students from Shishu-Kan on the following topics.

1. Procurement of electricity from renewable energy sources
2. Side effects of decarbonization
3. Renewable energy development and its coexistence with local communities

Participants touring the Square Lab

VOICE

Comment from a Course faculty member

Program-Specific Professor at Kyoto University, Shishu-Kan
Hashimoto Michio

There are many examples of industry-academia collaboration, but more often than not the academia of industry-academia only means faculty, not students. We wondered if students, especially doctoral students with their cutting-edge expertise and fresher minds, could be new partners with industry. With this in mind, we began this initiative. When we tried it, it was a real eye-opener—and some raw nerves were hit, but we became aware of a lot of different things. And it was a valuable opportunity for students to exchange knowledge with the real world.

Comment from a Course faculty member

Program-Specific Professor at Kyoto University, Shishu-Kan
Shimizu Mika

While the resilience thinking and approach I promote came from the academic world, it is very relevant to human resources development, SDGs, and innovation in business. It is no exaggeration to say that resilience thinking is one of the essences for a company to survive in symbiosis with various elements in global society. It is really great to witness the synergy among different elements and the dynamic changes among participants that arise through this series of workshops. By organizing these workshops, I hope to create a collaborative path toward achieving the SDGs.

Comment from participant in Metals Business Study Group

Kyoto University, Shishu-Kan (2nd year student)
Mutsuda Kaori

My research field is tissue engineering, and I chose the Advanced Study of the Metals Business class because of its unique curriculum and the positive feedback I received from senior students. In fact, I learned from JX Nippon Mining & Metals employees not only upstream and downstream business operations, but also efforts toward environmental and social impacts. By learning from JX Nippon Mining & Metals in terms of how the company has grown and evolved while facing numerous challenges, such as the depletion of mineral resources, environmental pollution, advancement into overseas markets, and intensified global competition, I hope to identify my own *core technology*, to repeatedly challenge myself, and to brush up my decision-making capabilities.

Comment from participant in Metals Business Study Group

Kyoto University, Shishu-Kan (2nd year student)
Sebastian Escobar

I'm very grateful to have had the opportunity to collaborate with JX Metals company as part of Kyoto University's exchange program. It was a very rewarding experience, both personally and professionally. I would love to have more opportunities to collaborate in the future.