PROTERIAL

Proterial, Ltd.

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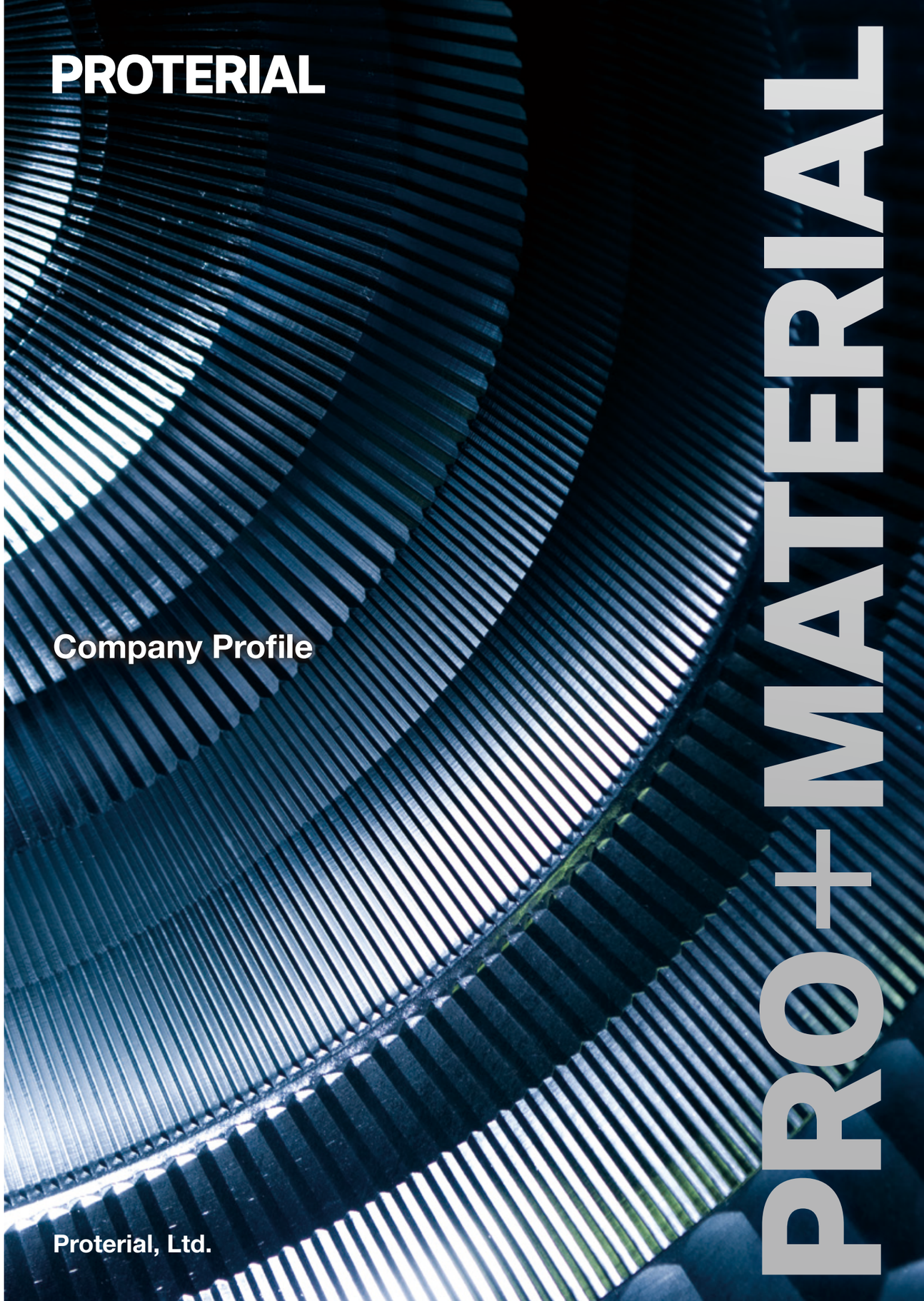
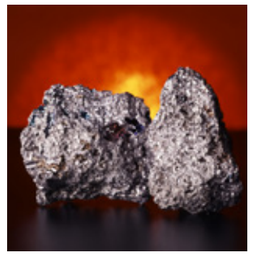


Inheriting the spirit of Tatara ironmaking, and bringing out the power of materials with superior craftsmanship.

PRO+MATERIAL Story

Nittoho Tatara



Tamahagane

Japanese Sword

Tatara ironmaking (a traditional Japanese ironmaking method originating in the 6th century) is the only technique capable of producing tamahagane (jewel steel), the indispensable material for crafting Japanese swords, which hold immense artistic and cultural value.

Tatara ironmaking harnesses nature's gifts—iron sand and charcoal. Under the guidance of the murage (master craftsman overseeing the furnace), operations continue day and night for three days to produce tamahagane. In ancient times, sustainable resource management was also practiced in Tatara ironmaking: trees were replanted after charcoal harvesting, and former iron sand extraction sites were restored as terraced rice fields. These sustainable practices gave rise to the beautiful landscape of Okuizumo's deep forests and terraced rice fields, which have been designated a Globally Important Agricultural Heritage System.

Proterial is deeply connected to Tatara ironmaking, placing its philosophy at the very foundation of its manufacturing. By fusing craftsmanship with cutting-edge metal structure and composition control technology, we maximize the potential of materials while actively pursuing resource recycling and reducing environmental impact. From the lessons of Tatara, we have embraced the spirit of sincerely creating beautiful steel, and transformed it into cutting-edge technology, creating high-performance materials that help solve social challenges.

Terraced rice fields of Okuizumo

Torikami charcoal pig-iron making factory with a tall furnace

Note:
1. Proterial has been supporting the operation of the Nittoho Tatara (a traditional Tatara ironmaking furnace run by The Society for Preservation of Japanese Art Swords) since 1977 (then as Hitachi Metals, Ltd.), in order to carry on the technology and culture of Tatara ironmaking, the origin of its main Yasugi Works.
2. Kaoru Horio of Proterial has been appointed as the murage (chief master of Tatara operations) of the Nittoho Tatara.

Proterial's Evolution Driven by Structural and Compositional Control Technologies for Metals

Since our founding in 1910 as Tobata Foundry, Proterial has advanced for more than a century with structural and compositional control technologies for metals as its core strength. Through collaborative creation with customers, we have delivered high-quality, high-function products and services, expanded our business domains, and promoted global growth. Today, we continue to take on new challenges in emerging material fields and new markets, driving Proterial's ongoing growth.

Our Origins and Technological Foundations

Founded in 1910 as Tobata Foundry, the predecessor of Proterial. The company took shape through the integration of Yasugi Steel Works—originating from Unpaku Steelworks (founded in 1899), itself in the lineage of Tatara ironmaking.

Nittoho Tatara

Inheritance of Tradition

Tatara ironmaking is an ancient Japanese ironmaking method that was introduced from the Asian mainland in the late 6th century and perfected during the Edo period. Proterial's main plant, the Yasugi Works, is rooted in this Tatara tradition. Its spirit of relentless pursuit of high quality and dedication to achieving the optimal composition and properties lives on in Proterial's manufacturing today.

Advancement and Global Expansion of Structural and Compositional Control Technologies for Metals

Through technological innovation and strategic M&A, we expanded our business from special steel to include magnetic materials, power electronics materials, and electric-wire materials, establishing a global supply network.

Expansion of Technology

By continuing to refine our knowledge and technical capabilities in structural and compositional control technologies, we are creating products that demonstrate the potential of materials to the fullest extent. With an uncompromising commitment to quality, we deliver stable supplies of optimal, high-performance materials that exceed expectations, through collaborative creation with our partners.

In addition, through M&A and strategic partnerships, we have acquired outstanding technologies and expanded globally across diverse sectors—primarily automotive, electronics, and industrial infrastructure—serving top-tier customers in a wide range of industries for many decades.

Toward a Sustainable Future

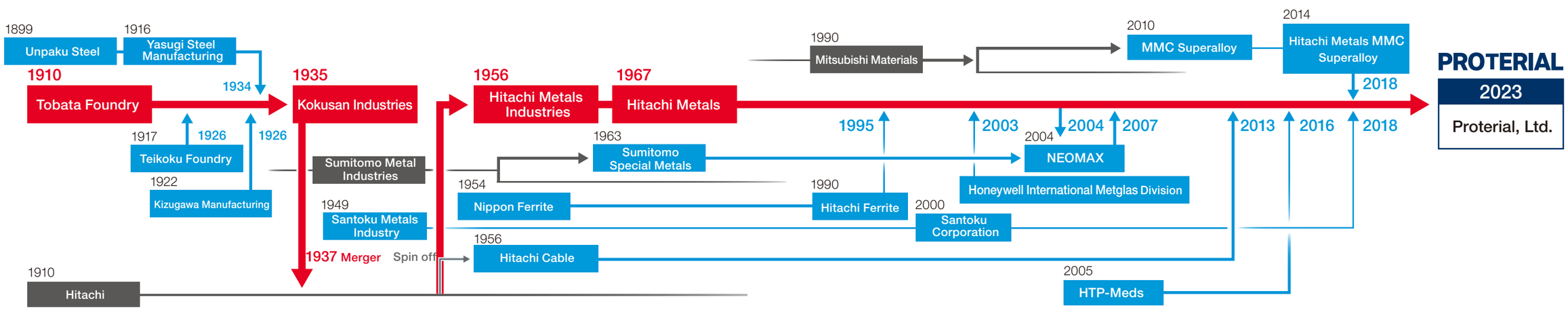
In 2023, we adopted the company name Proterial. Centered on our structural and compositional control technologies for metals, we are creating value that contributes to solving social challenges, including electrification of automobiles, improved energy efficiency, and the realization of carbon neutrality.

Expanding into New Fields

As a Green Enabler, Proterial is committed to providing advanced materials and technologies that help our customers and society address environmental issues and achieve a sustainable society. Our dedication extends not only to resource recycling and reducing environmental impact in our own manufacturing, but also to upholding sustainability principles across the entire supply chain—from environmental stewardship to human rights and safety. With highly functional materials, Proterial is paving the way to a sustainable future and delivering value to the world.

History: The Journey Toward Making the Best Quality Available to Everyone

Since its founding in 1910, the Proterial Group has continued to make the best quality available to everyone to meet our customers' needs. Based on our commitment to high-quality products, we have expanded into the global market from very early on and built an internationally competitive brand. Our relentless pursuit of quality has been passed down through our development of original products and our cultivation of human resources. By providing high-quality products and services, we aim to contribute to people around the world and create a prosperous society.



1900 — 1950 — 2000 — 2020

1910 Tobata Foundry

At a time when a modernizing Japan relied on imports for almost all of its industrial goods, Yoshisuke Ayukawa acquired malleable cast iron manufacturing technology and established Tobata Foundry, the predecessor of the Company. In 1912, the company began manufacturing Gourd-brand black heart malleable cast iron pipe joints. The company later expanded products for other uses including shipbuilding, railways, and spinning machines, and orders grew steadily as the superior quality of these products was recognized. Business areas were diversified through mergers with Teikoku Foundry, which at the time was producing steel for steel rolling, Kizugawa Manufacturing, a producer of fittings, and steelmaker Yasugi Steel Manufacturing.

1935 Kokusan Industries

As the business expanded to cover heavy industries in general, Tobata Foundry changed its name to Kokusan Industries.

1956 Hitachi Metals Industries

Hitachi transferred its metals business with five originally Tobata Foundry plants (Tobata, Fukagawa, Kuwana, Wakamatsu, and Yasugi) to establish Hitachi Metals Industries.

1967 Hitachi Metals

Hitachi Metals Industries changed its name to Hitachi Metals. Through creative monozukuri and proactive mergers and acquisitions, the company went through a succession of changes and grew to become one of the world's leading materials manufacturers.

1995 Hitachi Ferrite

Merged with Hitachi Ferrite in 1995 to strengthen the soft magnetic materials business in response to increased demand for noise reduction in automobiles and electronics.

2003 Honeywell International's Metglas Division

Acquired the Metglas™ (amorphous metal materials) Division of Honeywell International of the United States. Strengthened the soft magnetic materials division as demand in the electronics segment grew for size and weight reductions, energy conservation, and electromagnetic noise reduction.

2007 NEOMAX

Established through the merger of the magnetic materials and applications operations of Hitachi Metals and Sumitomo Special Metals to manufacture high-performance neodymium magnets and ferrite magnets widely used in motors for automotive equipment and home appliances. With demand for automotive-use motors expected to grow, the merger was carried out in 2007 to integrate the magnetic materials businesses and to increase synergies.

2013 Hitachi Cable

Merged with Hitachi Cable, the Hitachi Group's electric wires and cable business, in 2013. As the pace of movement toward a low-carbon society accelerated, the merger was intended to create synergies in terms of technologies and sales in the automotive, electronics, and industrial infrastructure segments.

2014 Hitachi Metals MMC Superalloy

Made MMC Superalloy, with extensive experience and technological capabilities in aircraft parts, a subsidiary with a view toward global growth in core industries including aircraft and energy. Hitachi Metals' Okegawa Works established in April 2018.

2018 Santoku Corporation

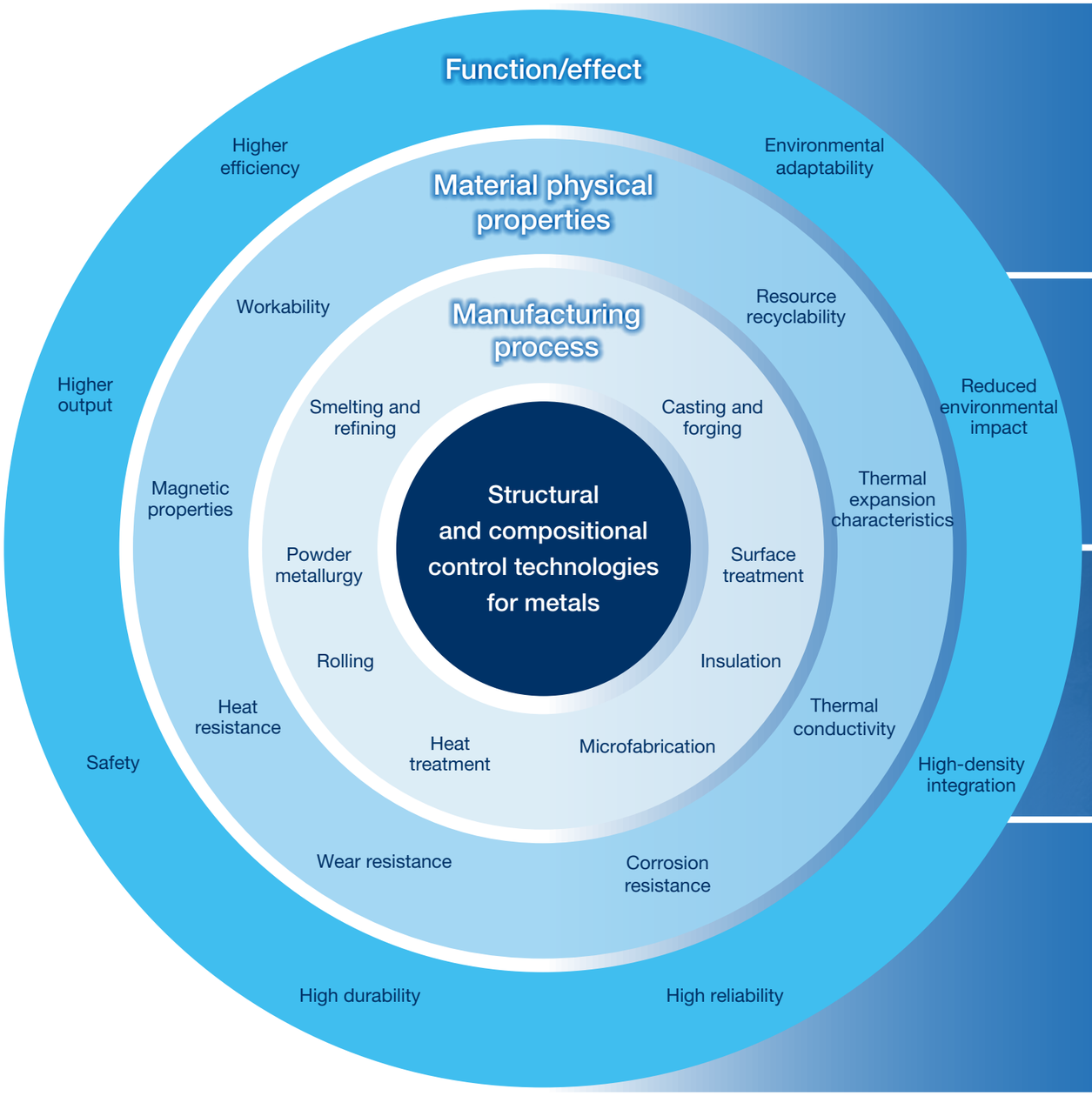
Made a subsidiary to strengthen the production system for neodymium magnets and to optimize the material flow from raw materials to finished products.

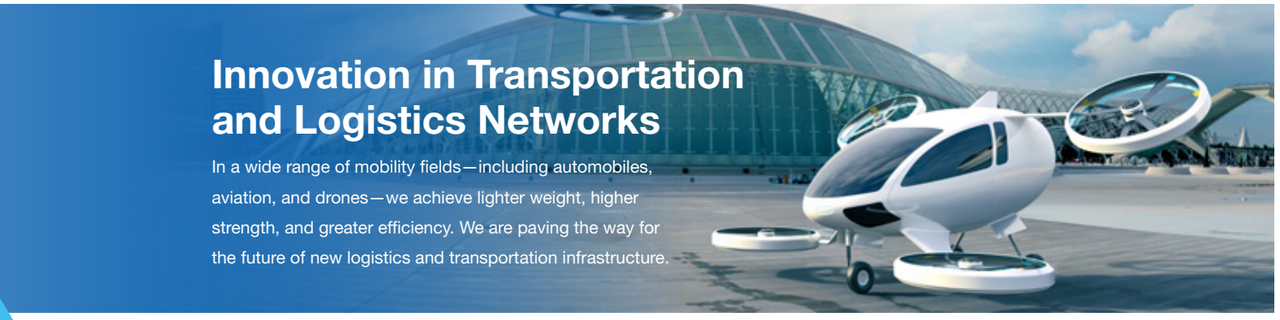
2023 Proterial, Ltd.

In January 2023, the Company's name was changed from Hitachi Metals, Ltd. to Proterial, Ltd. Moving forward, Proterial will continue to contribute to the realization of a sustainable society by providing high-quality products and services.

Addressing Diverse Social Challenges Through Structural and Compositional Control Technologies for Metals

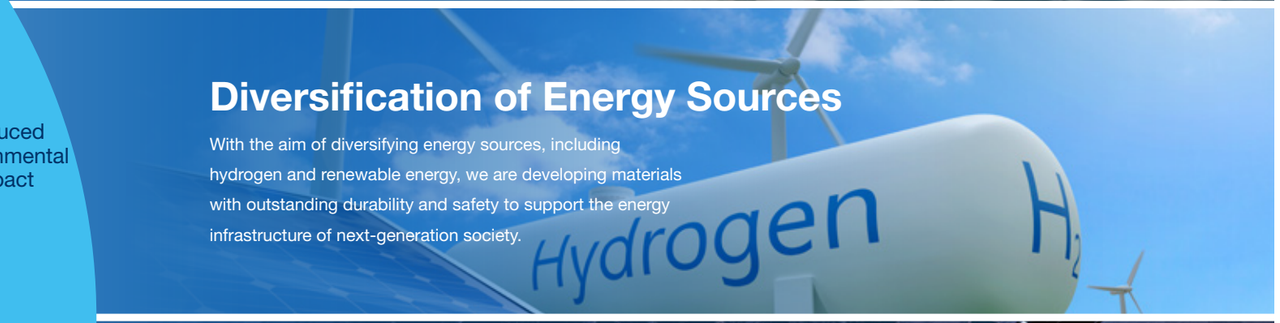
The structural and compositional control technologies for metals we have cultivated over a long history meet the new and increasingly complex challenges faced by society and industry. At the forefront of change in energy, environment, mobility, and AI, Proterial's advanced materials are expanding new value and possibilities.





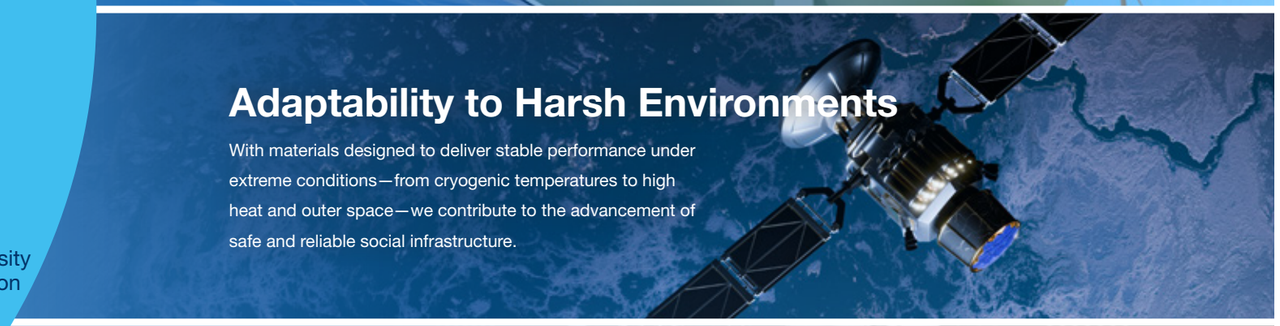
Innovation in Transportation and Logistics Networks

In a wide range of mobility fields—including automobiles, aviation, and drones—we achieve lighter weight, higher strength, and greater efficiency. We are paving the way for the future of new logistics and transportation infrastructure.



Diversification of Energy Sources

With the aim of diversifying energy sources, including hydrogen and renewable energy, we are developing materials with outstanding durability and safety to support the energy infrastructure of next-generation society.



Adaptability to Harsh Environments

With materials designed to deliver stable performance under extreme conditions—from cryogenic temperatures to high heat and outer space—we contribute to the advancement of safe and reliable social infrastructure.

Advancing the AI Ecosystem

To support the increasingly advanced and fast-paced AI society, we provide cutting-edge materials for electronics and next-generation devices that combine reliability with high performance.

High-performance Materials for Realizing Customer Innovation

Power Generation and Distribution

Proterial is the world's leading manufacturer of amorphous alloys, which are metals that do not have a crystalline structure. Amorphous alloys are used as core materials in distribution transformers, pole-top transformers, industrial transformers, and transformers for solar power generation and wind power generation, etc. Amorphous alloy transformers demonstrate one-third the iron loss (no-load loss) compared to transformers with grain-oriented electrical steel plate cores, and thereby contribute to reductions in power consumption. In recent years, significant anticipation has therefore been placed on their application to motor cores.

Aircraft

The aircraft market is expected to broaden significantly over the medium- to long-term. With a view to the expanding market for aircraft engine components, we have made large investments in the past, including a 10,000-ton free forging press, a 24-ton vacuum induction melting furnace (VIM), and an 840-ton large ring rolling mill. This is an area where the required level of technology, quality and management is extremely high, and it is also used in the H3 Launch Vehicle of the Japan Aerospace Exploration Agency (JAXA).

Railway

Our wires and cables for rolling stock are used in cab wiring, underfloor wiring, and wiring between rolling stock in Shinkansen bullet trains and many other rolling stock vehicles in Japan and overseas. Extra-high-voltage cable joints have metal shielding for excellent insulating performance even in contaminated environments, enabling a stable supply of electricity from the pantograph to the transformer. The trolley wires that supply power to pantographs are highly wear-resistant and strong, and are used not only for the Shinkansen but also across JR and private railway lines. Replacing conventional metal wires that are susceptible to electromagnetic noise during operation, the fiber-optic alarm trolley wire system—featuring embedded optical fibers—enables 24-hour real-time wear monitoring. By 2030, this system will be installed across the entire Tokaido Shinkansen line.

xEVs*

We play an important role in making xEVs smaller, lighter, more efficient, and more energy efficient. The NEOMAX® neodymium magnets we invented in 1982 possess world-class magnetic properties as permanent magnets and contribute to higher performance and miniaturization of drive motors. We have also successfully developed high-performance rare earth magnets, and have started to propose the use of ferrite magnets that do not use heavy rare earths as a material for drive motors. Furthermore, we supply magnet wire, which is required to be highly efficient and reliable, for use in motors. Silicon nitride substrates, SiC epitaxial wafers, and FINEMET® nanocrystalline soft magnetic materials are used in power semiconductors, which are key devices in xEV on-board chargers and other equipment. In addition, clad materials contribute to lighter, smaller and higher capacity lithium-ion batteries. Proterial supports the evolution of xEVs with these high-performance materials.

Hydrogen-related Facilities

Reducing carbon dioxide (CO_2) emissions is an important issue, and we are focusing on the realization of a hydrogen society as a solution to this. We will contribute to the realization of a decarbonized society by proposing solutions to the challenges of its realization with a product lineup that supports the making, storing, and using of hydrogen-related equipment, such as hydrogen storage alloys, high-strength alloys, and hydrogen embrittlement-resistant materials.

Industrial Equipment

Molds and tool steel, the material used for molds, achieves a high-level balance of conflicting properties such as machinability and wear resistance. Rolls for steel mills contribute to the production of high-performance steel sheets, including high-tensile-strength steel. Cylinders and screws for injection molding machines contribute to the production of high-quality plastic products. In addition to electric wires and cables, FA (factory automation) robots use neodymium magnets, ferrite magnets, and enameled wire as motor components. In addition, high-performance materials such as amorphous alloys for transformer cores, which reduce power transmission losses, contribute across a wide range of industries.

Medical Devices

With our ultra-fine cable, tube and ceramic products, we will help improve the performance of medical devices and contribute to the progress of medical treatment. Medical tubes, manufactured with advanced tube forming and processing technologies as well as precision mold-making expertise, include high-end products such as multi-lumen tubes for catheters and high-pressure-resistant tubes. Probe cables for ultrasound diagnostic equipment are not only lightweight, highly flexible, and bend-resistant, but also possess excellent electrical properties, ensuring ease of handling and enabling higher-resolution imaging. Ceramic scintillator materials are used in medical equipment such as X-ray CT scanners, as well as in analytical instruments. In recent years, demand has also been growing for security applications.

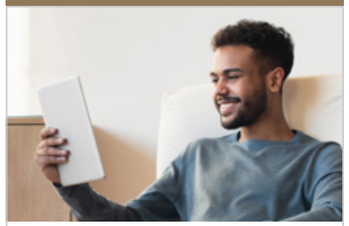
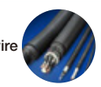
Smartphones

We are contributing to the realization of smartphones that are compact, lightweight, and power-efficient, while also being highly functional. Clad materials are used as heat sinks because they realize high strength and high thermal conductivity through the combination of stainless steel and copper. The nanocrystalline soft magnetic material FINEMET® contributes to noise reduction and also to highly efficient wireless charging. Neodymium magnets are used in speakers and vibration motors, contributing to size reduction.

* xEV: A collective term for electric vehicles (EV), hybrid electric vehicles (HEV), and plug-in hybrid electric vehicles (PHEV).

A Business Portfolio that Meets Diverse Social Needs

The Proterial Group is a material manufacturer with highly competitive core technologies for high-performance materials. With the world's top brands in its portfolio, Proterial engages in a broad range of businesses in the automotive, railway, electronics, and industrial infrastructure related markets. Our business foundations are broad, and our business structure, which is always responsive to the wide-ranging needs of society through the blending of technologies, has been the driving force behind the Group's growth.

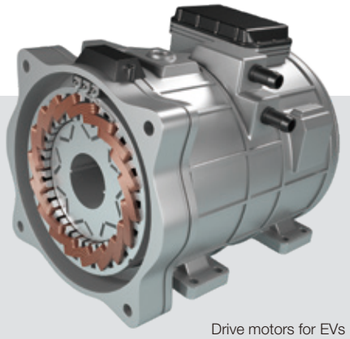
		Automotive and Railway	Electronics	Industrial Infrastructure
				
		We fully understand the increasing sophistication of performance across the entire mobility sector, and are relentlessly pursuing the evolution of all of our products. We use our development and technological capabilities to support mobility manufacturing around the world, from materials and parts for xEV drive motors and engines, to electrical components for automobiles, to high-performance components for railways.	The fields of IT equipment, home appliances, batteries and medical devices are constantly evolving. Encompassing the entire process, from prototypes to commercialization and mass production, our production system allows us to meet our customers' diverse needs. We will continue to support the growth of society at large with high-performance components and materials.	Aircraft components, power generating equipment-related components, and other industrial equipment are all exposed to severe operating conditions. Our technologies, quality and product development capabilities, which were developed and proved over many years, have always manifested innovation. We will continue to provide high-level reliability and innovation for infrastructure globally.
Specialty Steel	Molds and tool steel, Automobile-related materials, Razor and blade materials, Precision cast components, and Aircraft- and energy-related materials, Display-related materials, Semiconductor and other package materials, and Battery-related materials	 CVT belt materials  Molds and tool steel	 Clad metals  Lead frame materials	 Turbine cases
Roll	Rolls for steel mills, Injection molding machine parts, Structural ceramic products, and Steel-frame joints for construction			 Rolls for steel rolling  Cylinders and screws
Magnetic Materials	Neodymium magnets NEOMAX®, Ferrite magnets NMF™, and Other magnets and applied products	 Neodymium magnets NEOMAX®  Ferrite magnets NMF™	 Magnetic applied products	
Power Electronics Materials	Soft magnetic materials (Amorphous metals Metglas™; Nanocrystalline magnetic material FINEMET®; and soft ferrite) and applied products, and Ceramic components	 Nanocrystalline soft magnetic material FINEMET®  SiC substrates	 Silicon nitride substrates	 Amorphous alloy Metglas™
Electric Wire & Cable	Industrial cables, Electronic wires, Electric equipment materials, Cable assemblies, and Industrial rubber products	 Magnet wire  Electrical wire for rolling stock	 Electrical wire for medical devices	 Cables for industrial robots
Automotive Components	Electronic components for automotive, and Brake hoses	 Harnesses for electronic parking brakes		

Automotive and Railway

From the pursuit of fuel efficiency and safety performance to the spread of eco-friendly cars and the improvement of railway efficiency. We fully understand the increasing sophistication of performance across the entire mobility sector, and are relentlessly pursuing the evolution of all of our products. From materials and parts for xEV drive motors and engines, to electrical components for automobiles, to high-performance components for railways. We use our development and technological capabilities to support mobility manufacturing around the world.

Higher Output Density in Motors

As electrification of automobiles and energy efficiency advances, motors are required to deliver even higher output and efficiency. Proterial leverages diverse metal materials, magnetic materials, and insulation technologies to achieve smaller and lighter motors while simultaneously increasing output density. We provide optimal solutions that address designers' challenges on a global scale.



Drive motors for EVs

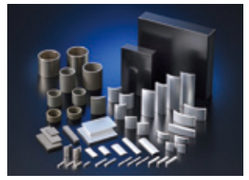
Balancing torque with rotational speed is essential for maximizing motor performance. In addition, for efficient design, it is crucial to make use of the electrical input conditions while minimizing total system losses. Proterial provides materials that deliver improved output from four perspectives.

Output = Torque × Rotational Speed
Output = Voltage × Current
Output = Input – Losses

Higher Torque

High-flux-density materials enable greater torque without changing motor size. This enhances design flexibility, contributing to space savings and efficiency gains.

Permendur
YEP™-2V

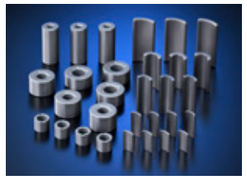


Neodymium magnets
NEOMAX®

Higher Rotational Speed

Stable performance is maintained even during long periods of operation by suppressing energy loss and heat generation in high-speed ranges.

Amorphous alloys
Metglas™



Ferrite magnets
NMF™

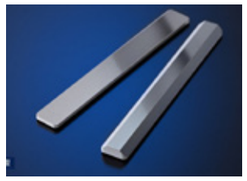
Higher Voltage

Reliable insulation performance is maintained even under harsh conditions, which contributes to longer service life and improved safety.

Inverter surge magnet wires
High PDIV magnet wire

Lower Loss

Optimizing magnetic flux distribution not only suppresses energy loss but also reduces unwanted vibration and noise. This enhances motor quietness and durability.

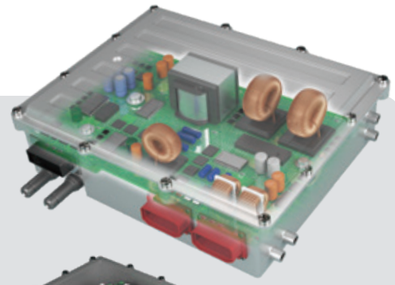


Magnetic wedges

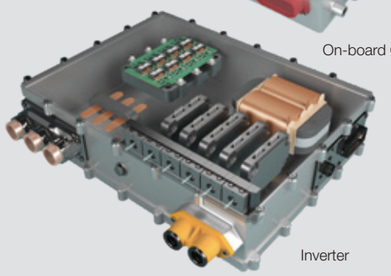
Higher Efficiency in Inverters and Converters

Inverters and power modules serve as the core of xEVs and industrial machinery, performing essential functions such as power conversion and motor control. This is an area where daily evolution is required, where products are becoming highly efficient, highly reliable, compact, and light weight, and where expectations for environmental friendliness and durability are increasing.

Against this background, inverters and power modules face multiple challenges: achieving compact, high-efficiency performance, ensuring stable and low-noise control, and maintaining safety and long service life even in high-temperature environments. Proterial is working to comprehensively solve problems from three perspectives: low loss, low noise, and thermal management, and is supporting the next generation of high-performance electric equipment.



On-board Charger



Inverter

Low Loss

By employing low-loss materials and specialized designs, we minimize energy loss while achieving highly efficient power conversion. This also contributes to energy savings, higher output, and miniaturization of the entire power module.

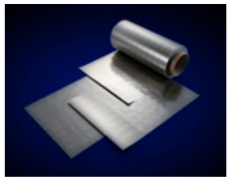
Soft ferrite
MaDC-F™

Cut cores for high-frequency transformers and reactors

Low Noise

Electromagnetic noise generated by power semiconductor switching is reduced through core and shielding materials. Enhanced EMC noise countermeasures improve equipment safety and reliability.

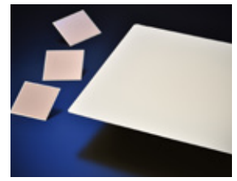
Common mode choke coils and cores



FM SHIELD™ magnetic shielding sheets for noise suppression

Thermal Management

Efficient heat management is essential for maintaining the performance and reliability of power modules. Proterial proposes optimal thermal management, contributing to higher output, longer lifespan, and stable operation of modules.



Silicon nitride (Si_3N_4) insulating substrates

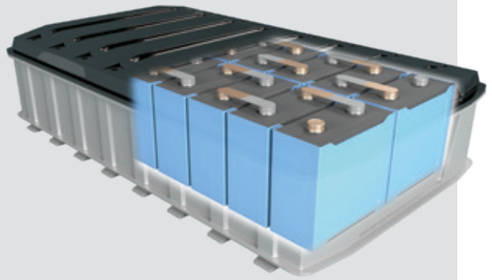
Silicon carbide (SiC) substrates

Automotive and Railway

Enhancing the Added Value of Batteries and Reducing Environmental Impact

As electrification of society expands, batteries are required to meet increasingly diverse and sophisticated needs such as high reliability, long life, and high efficiency. Batteries are no longer simply energy storage devices; they are a key core technology that influences mobility performance, efficiency, and sustainability, and the entire social infrastructure.

To meet these evolving demands, we are combining optimal metal materials and processing technologies with cutting-edge proprietary technologies in both battery design and material manufacturing processes, thereby increasing added value and contributing to the realization of highly reliable, efficient, and environmentally friendly batteries, paving the way for the evolution of next-generation batteries.

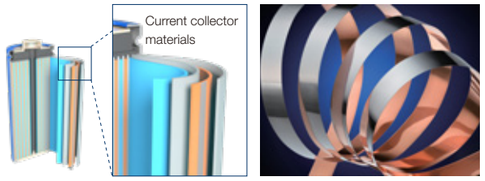


Battery

Higher Input/Output

Cladding Metals for Secondary Batteries

Through proprietary alloy design and precision processing technologies, we achieve both weldability and high conductivity inside batteries. This supports battery designs with high energy efficiency and fast charge/discharge capability.



Cladding metals for secondary batteries

Improved Connection Reliability

Clad Terminals for Lithium-Ion Batteries

By using specialized materials that securely bond dissimilar metals, complex processes that were previously required can be eliminated. This improves the reliability and durability of connections, enables weight reduction, and contributes to enhanced productivity.

CLAMET™ clad terminals for lithium-ion batteries

Reduced Environmental Impact

Cathode Material Manufacturing Technology

We have developed manufacturing technology that can, through the introduction of new manufacturing processes and material technologies, reduce CO_2 emissions during cathode material production by 36% compared to conventional methods. We also provide battery solutions that enable sustainable manufacturing processes.

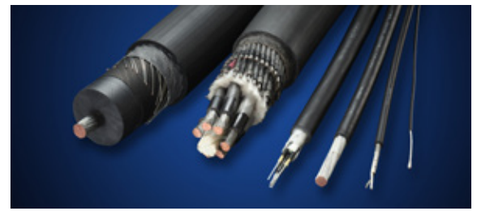
CALISMAT™ cathode material manufacturing technology

Supporting the Future of Railways

Proterial offers a wide range of products for railway infrastructure in Shinkansen (bullet trains) and other types of infrastructure both in Japan and overseas, including electric wires and cables for rolling stock, contact wires for overhead lines, and various signal cables. These products not only reliably support vehicle drive, control, and communication, but are also highly durable and stable even in harsh environments. We have also developed monitoring systems that incorporate fiber optics to reduce the risk of breakage and improve maintenance efficiency by tracking the status of trolley cables in real time. These advanced technologies support safe and reliable railroad operations and contribute to the development of next-generation high-speed rail networks.

Wires and Cables for Rolling Stock

Our wires and cables for rolling stock are used in cab wiring, underfloor wiring, wiring between rolling stock and other applications in Shinkansen bullet trains and many other rolling stock vehicles in Japan and overseas. We also provide high-speed communication LAN cables and other products to support railway power supplies and information transmission.

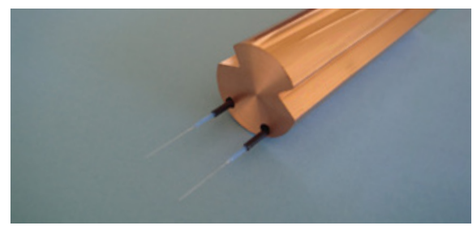


Joints for Special High-voltage Cables

Metal shielding provides stable insulation performance even in polluted environments, contributing to a consistent supply of power for rolling stock. In addition, since electrical isolation is not required, they offer a high degree of freedom in car body installation and help reduce noise during operation.

Fiber Optic Warning Contact Wires

Railway vehicles, including the Shinkansen, run on electricity supplied by overhead contact wires running above tracks through the vehicle pantographs. Fiber optic warning contact wire systems use optical fiber to detect wires, allowing them to constantly monitor the condition of contact wires as they wear down in real time.



Electronics

The fields of video/IT equipment, home appliances, batteries and medical devices are constantly evolving. With an integrated production system covering everything from development and prototyping to commercialization and mass production, Proterial responds to a wide range of customer needs. We will support the advancement of society through high-performance materials that expand the possibilities in fields related to communication and telecommunications.

Material Solutions Supporting Higher Performance of Smartphones

As smartphones and tablet devices continue to evolve, there are increasingly diverse needs for devices that are lighter, thinner, more reliable, more efficient, faster charging, have longer life, and are more durable, and more contactless charging and foldable devices are emerging. Proterial is a cutting-edge metal material that meets these needs and helps smart devices perform better.

High Speed, Large Capacity

Electroplating Technology with Conductive Ni-P Fine Particles for Semiconductors

With the increasing functionality of smartphones and tablets, semiconductor chips require lower resistance and higher heat resistance. In particular, chiplet technology faced challenges in reducing resistance at connection points, where conventional gold plating had reached its limits. Proterial developed Ni-P fine particles plated with silver or copper, reducing volume resistivity to about 1/5 or 1/9 that of gold plating. In addition, low-melting-point solder plating expands the contact area, enabling metallic bonding. This provides a new packaging technology compatible with high-speed, large-capacity signal transmission.

Plated Ni-P fine particles

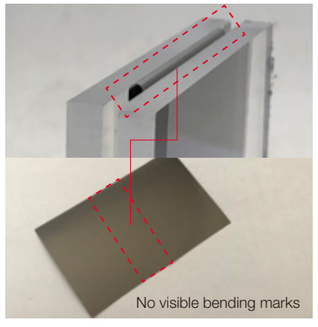
Evolution of Displays

Materials for OLED Panels

These materials are used in the back panels and metal masks of OLED panels. They are available in the form of thin sheets that restrict thermal expansion deformation, produced by our alloy composition control technology and cold rolling technology. For foldable devices, we also offer high-strength stainless steel.

Titanium Alloy Foil for Flexible Displays

Foldable devices require back-panel materials that can withstand repeated bending. Proterial has overcome the limitations of conventional stainless steel by developing a non-magnetic, lightweight titanium alloy (Ti-15-3-3-3). This reduces the bending radius to about two-thirds, contributing to durability, design flexibility, and weight reduction.



Titanium alloy foil
Top: Folded / Bottom: Unfolded

Thinner and Lighter Weight

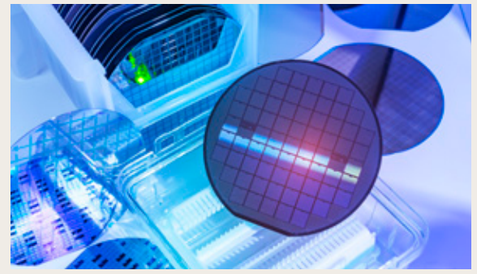
Clad Metals for Heat Spreaders

These clad metals combine stainless steel and copper to achieve both high strength and high thermal conductivity. In mobile devices such as smartphones and tablets, these materials contribute to thinner, lighter designs and a reduction in the number of components.

Clad Metals for Heat Spreaders

Enhancing Semiconductor Package Reliability (Heat Spreaders)

As devices become more advanced and faster, diverse technical challenges are emerging in areas such as heat dissipation, reliability, and assembly efficiency of package substrates and chips. Proterial offers optimal thermal management solutions centered on clad technology.



Balancing Heat Dissipation and Reliability

As heat spreader materials, we use clad materials that combine copper (Cu), which enhances heat dissipation, with Fe-Ni alloys, which excel in matching thermal expansion coefficients. This efficiently releases heat generated by the chip while relieving thermal stress, thereby improving reliability. In semiconductor packages that require ever higher performance and reliability, this contributes greatly to operational stability and longer product service lives, meeting the stringent quality requirements of next-generation devices.

Improved Packaging Process Efficiency

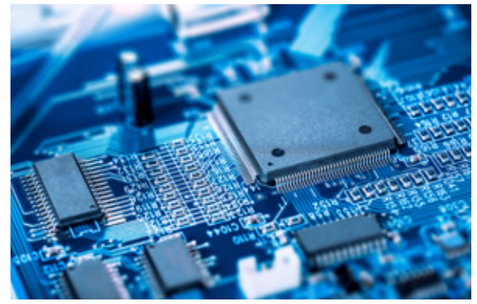
By adopting integrated clad-structure materials, the need for combining multiple materials and extra joining processes is eliminated. As a result, assembly processes are simplified and the number of components reduced, simultaneously improving productivity and lowering costs. This also enhances stability in mass production, while contributing to reduced environmental impact and shorter manufacturing lead times.

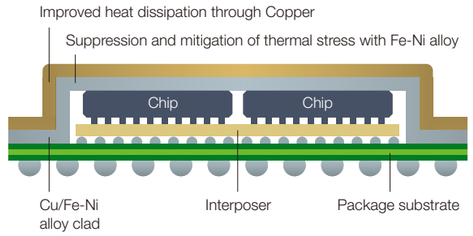
Advanced Precision Processing Technologies

Thickness and shape can be controlled to the micron level through proprietary metal bonding and processing techniques. This enables flexible response to miniaturization and thinness requirements in next-generation packages as they advance toward finer pitches and higher densities. It also expands design flexibility, ensures high-quality finishes, and contributes to optimal thermal design and electrical characteristics. The performance and reliability of electronic devices are further enhanced, strengthening competitiveness across a wide range of applications.

Heat Spreaders for CPUs/GPUs

Improved Reliability Through Matching Coefficients of Thermal Expansion





Mitigating heat dissipation and thermal stress in increasingly complex packages

Industrial Infrastructure

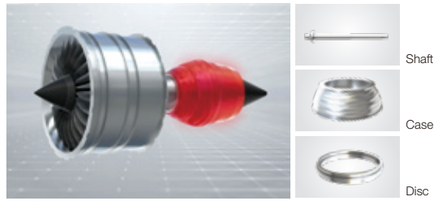
Aircraft components, power generating equipment-related components, rolling stock components and other industrial equipment are all exposed to severe operating conditions. Our technologies, quality and product development capabilities, which were developed and proved over many years, have always been bringing innovation to the industrial infrastructure field. We will continue to support the world's infrastructure with high-performance materials that contribute to customer safety and security while reducing environmental impact.

Aircraft Components Supporting Stable Flight

Achieving safe and reliable flight requires material innovations in every aspect, including lighter weight, higher strength, greater heat resistance, improved reliability, longer service life, and energy efficiency. Proterial supports both performance enhancement and operational optimization of aircraft components through advanced metal materials and proprietary technologies, drawing on perspectives from both design processes and actual flight operations.

High-Performance Materials for Extreme Environments

Safe and efficient aircraft operation requires material innovations across multiple aspects, including lighter weight, higher strength, greater heat resistance, higher reliability, and improved energy efficiency. In particular, components used in harsh environments such as jet engine parts demand safety and reliability that can withstand extreme conditions. Proterial provides materials that meet these high standards, drawing on decades of metallurgical expertise and world-class manufacturing facilities.



Aircraft engine

Advanced Facilities and Development Capabilities

Our research and development efforts have produced results that directly translate into improved engine efficiency and fuel economy. On the manufacturing side, we can supply high-purity, highly uniform materials using one of the world's largest vacuum induction melting furnaces and multiple vacuum arc remelting machines. We also utilize some of the world's leading forging equipment, including a 10,000-ton free forging press, a high-speed four-sided forging machine, and a 50,000-ton die forging press. We have also introduced automated process control using advanced technology to ensure stable quality even for large and complex components.

*Japan Aeroforge, Ltd. is jointly funded by six companies, including our company.

Manufacturing with Quality and Trust

At the mass-production stage, we provide seamless ring products using ring rolling mills and achieve mass production of difficult-to-process materials through structural and compositional control technologies for metals. Appropriate heat treatment enables us to provide materials that minimize processing deformation, allowing customers to achieve micron-level dimensional accuracy. Through meticulous management and rigorous inspection systems across all processes, we guarantee the world's highest level of quality and reliability demanded by the aviation industry, supporting manufacturing that is directly linked to customer safety and peace of mind.

Reducing Power Loss with Amorphous Alloys

As measures to combat global warming require energy conservation and reduction of greenhouse gas emissions, there are two important issues for transformers that support the power infrastructure: reducing power loss and recycling resources.

Proterial contributes to energy conservation and a recycling-oriented society through the spread of amorphous alloys.

Reducing Transformer Power Loss and CO_2 Emissions

Transformers that use the amorphous alloys Metglas™ in their cores can reduce power loss (no-load loss) to less than one-third* of that of conventional magnetic steel sheets. Transformers are devices that continue to operate for long periods of time, and can thus save energy over the long term by reducing power loss.

Proterial contributes to reducing power loss in transformers and curbing CO_2 emissions through the widespread use of amorphous alloys.

*Estimated based on transformer standard JIS C 4304:2024.

Metglas


Metglas™ amorphous alloy

An Amorphous Alloy Using Our Proprietary Magnetic Domain Control Technology: MaDC-A™

We have commercialized MaDC-A™, which achieves even lower iron loss by controlling the magnetic domain structure of amorphous alloys. Although reducing loss through magnetic domain structure control is a widely known technology in electrical steel sheets, it has not yet been put to practical use with amorphous alloys.

So, we developed our own laser processing technology, which has achieved a 25% reduction in iron loss compared to conventional materials.

MaDC-A

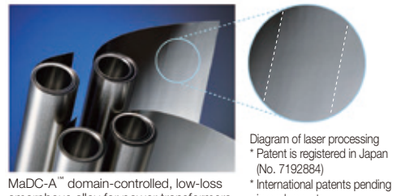
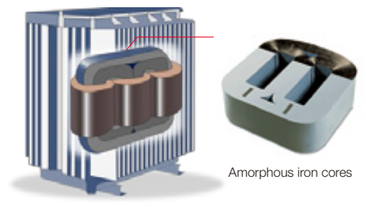

MaDC-A™ domain-controlled, low-loss amorphous alloy for power transformers

Diagram of laser processing
* Patent is registered in Japan (No. 7192884)
* International patents pending in each country

Amorphous Alloy Recycling

We have established a unique recycling system that collects, and remelts amorphous alloys that would otherwise be discarded.

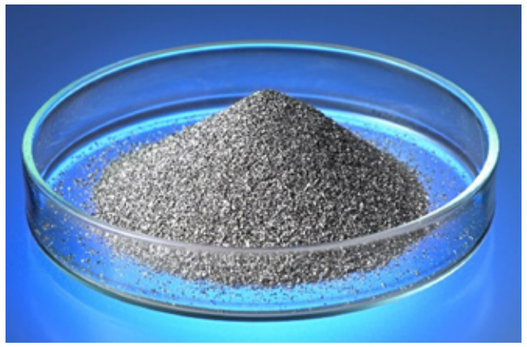
Proterial uses recycled resources to reduce waste and contribute to the realization of a recycling-oriented society.


Transformer interior

Amorphous iron cores

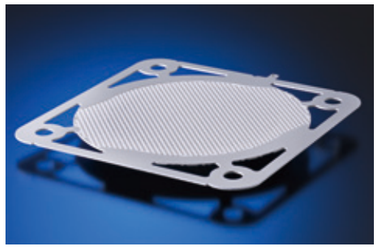
Industrial Infrastructure

Hydrogen-related



Hydrogen Storage Alloys

Hydrogen storage alloys can compress and store hydrogen gas in the form of metal hydrides [solid state], allowing hydrogen absorption and release at low pressures below 10 atmospheres [1 MPa]. Among hydrogen storage methods, they are one of the most compact and safest options. In the coming hydrogen society, they are optimal materials for hydrogen utilization in locations where safety and security are paramount or where installation space is limited.



Metal Interconnector Material ZMG™ 232G10 for SOFC/SOEC

This material, made primarily of iron and chrome, is used in interconnects that electrically link cells in SOFCs*1 and SOECs*2. It has oxidation resistance over long periods, good conductivity in high-temperature environments, and achieves nearly the same thermal expansion coefficient as that of electrolytes.

*1. SOFC: Solid Oxide Fuel Cell *2. SOEC: Solid Oxide Electrolysis Cell

Hydrogen Embrittlement-resistant Materials

This material is suitable for use in a hydrogen environment, specifically for components of hydrogen engines and hydrogen fuel stations. Developed using our long-established strong technology applied for internal combustion engine (ICE) parts, this product has high hardness and good corrosion resistance in addition to hydrogen embrittlement resistance.

Rolls

Rolls for Steel Mills

Our rolls for steel rolling mills have higher strength and wear resistance, and enable more efficient production of high-precision rolled products. A wide variety of products are available to manufacture steel plates, pipes, bars, and wires, as well as other shaped steels, to meet diverse demands from steelmakers. Most notably, our HINEX™ products, which were the first commercially available high-speed steel-based composite rolls in the world, and other high-speed steel composite rolls have significantly better rolling performance than traditional rolls and help improve rolling productivity and quality.

Molds and Tool Steel

DAC-i™ Steel for the Next-generation Standard Die-casting Dies

Compared to generic JIS SKD61, and DAC, our general-purpose steel for die-casting dies, this general-purpose steel is superior in high-temperature strength and ductility. In addition to our proprietary alloy compositional and structural control technology, a 10,000-ton-class free forging press introduced to our Yasugi Works delivers high performance.

DAC-X™ Steel for Die Casting Molds with Excellent High-temperature Strength and Toughness

This steel for die-casting molds combines an alloy design that provides high-temperature strength with a unique microstructure control process to achieve both high-temperature strength and toughness. It has excellent heat crack resistance and can extend the life of molds, especially in applications with high thermal load. It also contributes to reduce man-hours for mold repair as well as to improve productivity and quality in high-cycle die-casting products.

SLD™-f, New Cold Work Die Steel with Excellent Machinability and Toughness

With the diversification in recent demand for molds in the manufacturing of automotive frame components, SLD™-f provides solutions to reduce the total cost of molds by extending the life of molds and shortening the lead time of production.

Providing Environmental Value as a Green Enabler

Working to provide environmental value at each stage of the manufacturing process as a Green Enabler, we recognize our role in enabling customers to reduce their environmental impact through our products as a business opportunity. To provide value as a Green Enabler, we are working on **(1) producing and supplying products through processes that minimize environmental impact, and (2) developing environmentally friendly products**.

1 Producing and supplying products through processes that minimize environmental impact

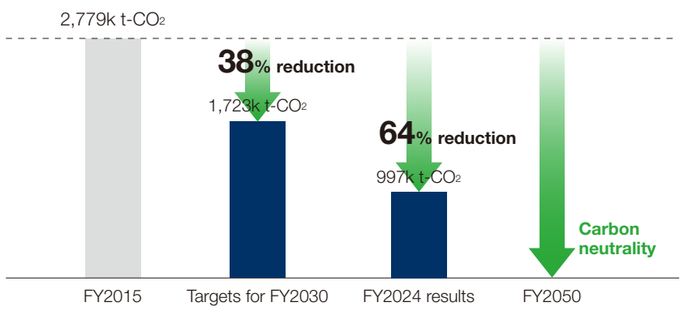
Proterial is working to reduce the environmental impact across the entire value chain from manufacturing to logistics. We promote the introduction of energy-saving and resource-saving manufacturing processes, reduction of CO_2 emissions, reduction of waste, and the active use of recycled materials. By building a sustainable supply chain, we work together with our customers to advance environmental initiatives.

Reduction of CO_2 Emissions

We aim to reduce CO_2 emissions (Scope 1 and 2) by at least 38% compared to FY2015, with the aim of becoming carbon neutral by 2050. We promote reductions by improving productivity, implementing energy-saving measures, and introducing renewable energy. In 2023, we sold a subsidiary with high CO_2 emissions, achieving our 2030 target ahead of schedule. We have already obtained external assurance for emissions from FY2022 to FY2024.

CO_2 Emission Reduction Targets (Group-wide)

We are ahead of our 2030 target



Deployment of Renewable Energy

Proterial is promoting the expansion of renewable energy use, aiming to exceed 35 million kWh/year (35,000 MWh/year) by FY2030. In February 2024, we began full-scale operation of Japan's largest on-site self-consumption solar power generation facility in the Kumagaya district (annual power generation: 11,500 MWh/year), and we are actively promoting the introduction of solar power at our global bases. As of the end of FY2024, the estimated amount of electricity generated from renewable energy sources is 38,000 MWh/year.

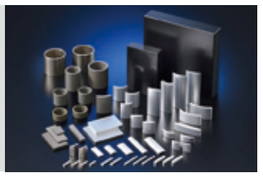
On-site solar power generation facilities for in-house consumption, installed at the Kumagaya district

2 Developing environmentally friendly products

We are also focusing on developing materials that contribute to improving energy efficiency and achieving carbon neutrality. We offer a range of products that combine energy savings and long life, including magnetic materials for electric and hybrid vehicles and amorphous alloys for high-efficiency transformers. We aim to reduce environmental impact and improve performance at the same time, across the entire product life cycle.

Proterial's Technology and Products	Environmental Value That Can Be Provided (from a development perspective)	Fields in Which Contributions are Being Made
	Energy saving Renewable energy Electrification of automobiles Smaller/lighter products Long product service lives Resource conservation Reduced use of chemicals	Energy: Photovoltaic cells, wind power generation, power generation equipment, home appliances, transformers, batteries, hydrogen Mobility: Automobiles, railways, aircraft Industrial / Other: Industrial equipment, electronics

Development of Heavy Rare Earth-Free Neodymium Sintered Magnet



Neodymium magnets offer high performance, but improving their heat resistance traditionally requires the addition of heavy rare earth elements. We have developed a high-performance neodymium sintered magnet free of heavy rare earths that achieves both high residual flux density (Br) and high coercivity (HcJ) without using any heavy rare earths, and can even be applied to drive motors in EVs. This product helps avoid the risks of heavy rare earth resource depletion while contributing to energy savings and CO_2 reduction through higher motor torque, miniaturization, and improved efficiency.

CALISMAT™ Environmental Impact Reduction Technology for Cathode Material Manufacturing Process

While the lithium-ion battery (LIB) market is attracting attention as EVs become more widespread, the environmental impact of the manufacturing process is becoming an issue. In particular, cathode materials and their raw materials account for more than 50% of total CO_2 emissions in xEV production, require large amounts of water, and pose waste treatment issues. Proterial has developed CALISMAT™ technology , which uses a solid-state reaction method that does not require precursor production. Compared with conventional processes, it has been confirmed to reduce CO_2 emissions by 36% and water consumption by more than 85%, all at equal or lower cost.

Research and Development

The Proterial Group is focusing on creating new products and new businesses aimed at realizing a sustainable society. We are promoting R&D digital transformation (DX) that uses digital technologies such as AI and Materials Informatics (MI) to solve our customers' problems, as well as manufacturing DX for achieving safe, high-quality workplaces that do not rely on people. We are engaging in collaborative creation through joint research with cutting-edge global research institutions in order to accelerate these efforts.

As an R&D organization, the Global Research & Innovative Technology center (GRIT), the R&D Division, and the Division Labs work in close collaboration, enabling the rapid development of new products and the creation of new business opportunities.

Global Research & Innovative Technology Center (GRIT)

GRIT is an organization established to solve social issues through collaborative creation with customers. As a cross-company organization, it shares information obtained from customers and markets, building a system that enables us to propose optimal solutions to customer challenges. We are also promoting strategic customer collaborative creation activities not only in North America and Europe but also in Asia and the rapidly growing Indian market.

Collaborative Creation Case Study

Next-Generation Tatara Co-Creation Centre

The Next-Generation Tatara Co-Creation Centre (NEXTA) was established at Shimane University as a facility that plays a central role in research and development and human resource development in the "Creation of a Global Base for Advanced Metals - Next Generation TATARA Project -", a project involving industry, government and academia in Shimane Prefecture. The ultimate goal of the Centre is to create a "Next Generation Tatara Culture," and it focuses on innovation and the improvement of metal materials. Members selected from Proterial serve as the project manager and deputy director of the Centre. We are also engaged in projects in specialized steel (super heat-resistant alloys for aircraft) and soft magnetic materials (mass production of amorphous motor cores).

Intellectual Property

The Proterial Group promotes the protection and strengthening of intellectual property through efficient intellectual property strategies and intellectual property activities that are coordinated with business and R&D, in line with business formats and new product development and deployment. In order to promote highly effective patent strategies in line with our business strategies, we are working to build and utilize an optimal patent portfolio for each business unit. We currently hold over 7,000 patents, more than half of which are foreign patents. In addition, we are advancing R&D in AI and MI, accumulating intellectual property while improving the efficiency of materials development. By integrating materials science and information science, we are accelerating the development of innovative materials that meet customer needs, while strategically promoting the protection and utilization of intellectual property.

Key Themes and Achievements of Research and Development

The key themes and achievements of research and development are as follows. These achievements are anticipated to contribute to environmental and social issues such as product-weight reduction, fuel efficiency and energy conservation, and decarbonization in industrial infrastructure and electronics-related fields as well as automotive related fields, where the shift to electrification (xEV) is expected to continue.

Segment	Key Themes and Achievements
New Materials and New Businesses	Development of innovative materials that contribute to solving social issues, development of innovative production technologies that utilize AI and robotics, fusion of advanced analytical technologies and AI/MI technologies that revolutionize materials development across the entire company **Key Achievements** • CALISMAT™ technology for manufacturing cathode active materials for LIBs estimated by FEV Consulting GmbH to reduce CO_2 emissions during production by 36% compared with conventional methods (2025). • Technology licensing initiated for ALectro™ high-purity aluminum electrodeposition technology (2024). • Developed D2Materi™, a proprietary MI platform (2023). • Developed powder "ADMUSTER™ L61P" applying Al6061, an Al6000-series aluminum alloy enabling metal additive manufacturing (2023). • Developed and launched ADMUSTER™-YAG™350AM, a high-hardness maraging steel additive manufacturing material (2023).
Specialty Steel	Development of materials, manufacturing methods, and related technologies for high-grade specialty steels, and metal 3D additive manufacturing for the fields of molds and tools, electronic materials, industrial equipment materials, aircraft and energy-related materials, etc. **Key Achievements** • Mass production of new aerospace and energy products using Japan Aeroforge Co., Ltd.'s state-of-the-art 50,000-ton forging press (2025). • Stabilized manufacturing of aircraft bearing steel through structural control (2025). • Began proposing Permendur YEP™-2V for motor cores targeting eVTOL aircraft (2025). • Developed electroplating technology with conductive Ni-P fine particles for semiconductors (2025). • Developed titanium alloy foil for flexible displays (2024). • Developed high-hardness, high-corrosion-resistant steel for blades (2024).
Roll	Development of materials, processes, and related technologies for various rolls **Key Achievements** • Developed high-performance cast rolls for cold rolling of steel
Magnetic Materials	Development of high-performance magnets, various other magnets, and their applied products **Key Achievements** • Developed high-performance heavy rare earth–free neodymium sintered magnets for xEV drive motors (2025). • Established technology for NMX-G1NH, a high-performance neodymium magnet that greatly reduces the amount of heavy rare earths used (2025). • Verified output exceeding 100kW, which can be applied to the drive motors of xEVs, using a ferrite magnet motor (2023).
Power Electronics Materials	Development of high-frequency parts and materials for information terminals, amorphous metal materials, nanocrystalline soft magnetic materials, ceramic products, and their applied products **Key Achievements** • Developed magnetic sheets and MS-HiQ series magnetic sheet panels for xEV onboard wireless charging systems (2024). • Developed MS-FH, a high heat-resistant magnetic shield sheet (2024). • Developed an amorphous alloy laminate adhesive ribbon for motor cores (2024).
Electric Wire & Cable/Automotive Components	Development of materials, manufacturing process technology and connection technology related to various electric wires and windings for industrial, vehicle/automotive, equipment, medical, etc., as well as electrical components and hoses for automobiles, industrial rubber, etc. **Key Achievements** • Developed low-environmental-impact copper recycling technology for xEV enamel wires (2025). • Developed large-diameter 0.4 mm electrode wire for electrical discharge machining, "HBZ-B40" series (2024). • Applied D2Materi™ MI platform to wire coating material development (2023). • Developed the new GT-SNNS170 trolley wire and deployed it on the JR Shikoku Seto-Ohashi Line (2023).

External awards

October 2024	New cold dies steel with high toughness and machinability received the Minister of Education, Culture, Sports, Science and Technology Award at the Chugoku Region Invention Honors for FY2024
November 2024	"Development of cold-work die steel with high machinability utilizing a protective coating to suppress tool damage" received the Chairman's Award of the Japan Die & Mold Industry Association at the FY2024 Formed & Fabricated Materials Industry Technology Awards.
December 2024	High-strength, highly wear-resistant "SNH Alloy Trolley Wire" received the Electrical & Electronic Components Award at the 2024 'CHO' MONODZUKURI Innovative Parts and Components Awards.
February 2025	Received the Okochi Memorial Foundation Technology Prize in the 71st Okochi Memorial Foundation Prize.

Proterial in Numbers

Global Reach

Supplying materials to workplaces across all industries

Number of customer companies supplied

Over **15,000** companies

Number of countries of operation

Over **70** countries

Human Resources and Safety

Diversity and a culture of safety underpin our growth

Number of employees

18,877 employees

Lost time injury rate (LTIR)

0.90

LTIR (Lost Time Injury Rate)
(Number of lost-time injuries / Total actual working hours) * 1,000,000

Research and Development / Intellectual Property

Technological capabilities that drive innovation and create competitive advantage

Annual R&D expenses

Over **10** billion yen

Number of patents held

Over **7,500** patents

About 10% of all employees work in research and technology development

Production and Facilities

Stable supply of high-quality products

Number of major production sites (global)

46 sites

Capital expenditures for advanced facilities

Approx. **35** billion yen

Sustainability

Actively creating environmental value as a Green Enabler

Reduction of CO_2 emissions

64%

(Compared to FY2015)

Amount of renewable energy deployed

19,185 MWh/year

Social Contribution

Contributing to the development of society as a good corporate citizen

Donations and social contribution activities

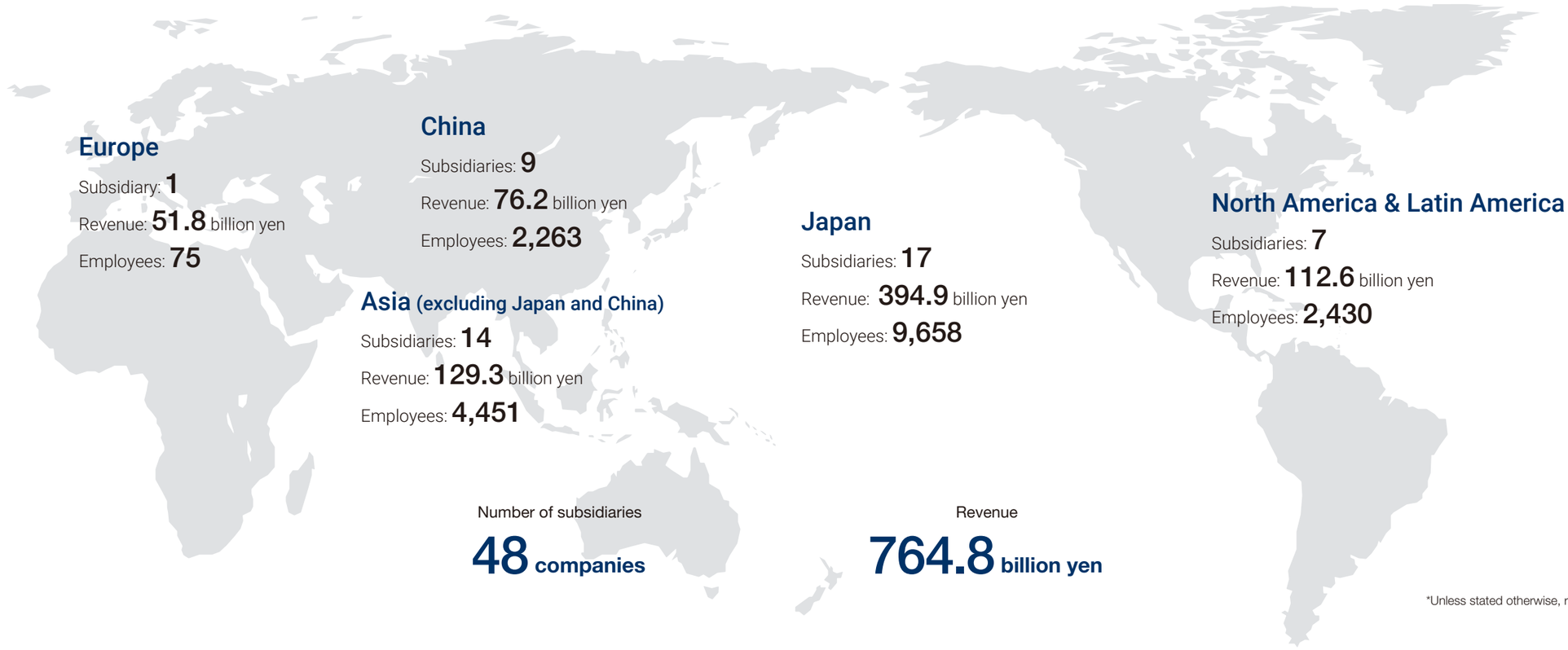
Equivalent to **36** million yen

(FY2024 results)

Research grants awarded by the Proterial Materials Science Foundation

428 total

(1986–2024)



Europe

Subsidiary: **1**
Revenue: **51.8** billion yen
Employees: **75**

China

Subsidiaries: **9**
Revenue: **76.2** billion yen
Employees: **2,263**

Asia (excluding Japan and China)

Subsidiaries: **14**
Revenue: **129.3** billion yen
Employees: **4,451**

Japan

Subsidiaries: **17**
Revenue: **394.9** billion yen
Employees: **9,658**

North America & Latin America

Subsidiaries: **7**
Revenue: **112.6** billion yen
Employees: **2,430**

Number of subsidiaries

48 companies

Revenue

764.8 billion yen

*Unless stated otherwise, results for FY2024 are shown.

Key Sustainability Commitments and External Evaluations

Commitments		External Evaluations	
United Nations Global Compact	**TCFD**	**EcoVadis, Inc. Sustainability Rating**	**CDP**
Signed in 2024 to express support for the UN Global Compact advocated by the United Nations.We promote business practices that align with the Ten Principles of the UNGC.	Declared support for the TCFD recommendations in 2021 and began disclosing information in line with the recommendations in 2022.	Proterial has received the "Silver" rating for the second consecutive year in the EcoVadis Sustainability Assessment, a highly reliable platform, which is awarded to the top 15% of companies evaluated.	In the 2025 assessment by CDP, an international environmental information disclosure platform, Proterial received an "A-" rating (second highest out of eight levels) in the climate change category and an "A" rating (highest rating) in the water security category.

The Thinking Behind our Company Name

"Proterial" combines "pro-" with the word "material."

"Pro-" represents elements of our Values :

- Unparalleled Professionalism
- Unbounded Progressiveness
- Unleashing Proactiveness

"Material" refers to the high-performance materials that our original technologies produce, underpinned by the three pros.

With our focus on solving customer issues and bringing new levels of value, we promise to contribute to the realization of a sustainable society through the products and services that embody our philosophy.

PRO + MATERIAL

PROTERIAL

Corporate Data

Company name	Proterial, Ltd.
Head Office address	Toyosu Prime Square, 5-6-36 Toyosu, Koto-ku, Tokyo 135-0061, Japan
Founded	1910
Established	1956
Website	https://www.proterial.com/e/

Message from the CEO

Shaping the Future Together with Our Customers

Sean M. Stack
Chairperson, President, & CEO

In 2023, under our new name Proterial, we began a new journey toward the next 100 years. Since our founding in 1910, we have created high-performance materials for the mobility and electronics fields, built on our core strength: structural and compositional control technologies for metals.

What we have always pursued above all is uncompromising quality.
To enable our customers' innovations and contribute to the realization of a sustainable society, we continue to refine not only our technologies and products, but also the processes and people that create them—constantly generating new value.
This is the foundation of Proterial's manufacturing and the mission we have inherited across generations.

Today, as a Green Enabler, we are working alongside our customers in their sustainability efforts—reducing CO_2 emissions, improving energy efficiency, and opening up new possibilities together.

Building on more than a century of history and our core technologies, we will continue to walk together with our customers and society, striving to be a high-performance materials company that supports a sustainable future.
We sincerely ask for your continued support of Proterial.