

2. Environmental Consideration in Products

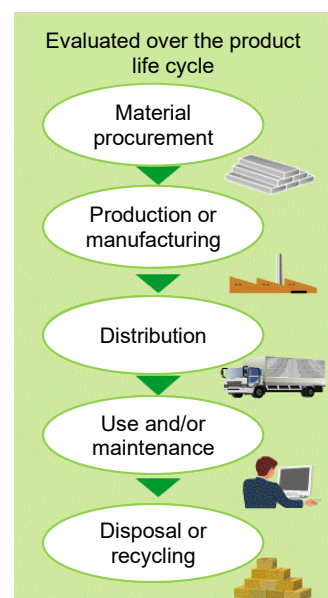
The Hitachi Metals Group considers “Thinking about the next generation—An environment-friendly solution” an important managerial issue. We contribute to the realization of a sustainable society through the creation of new products and new technologies that meet such needs, as well as through the provision of advanced environmentally conscious products.

(1) Environmentally Conscious Vision in Products and Services

For the purpose of contributing to the realization of a sustainable society, the Hitachi Metals Group is focusing attention on the environmental and energy sectors as we promote the development of new products. Moreover, for the development and design of such new products, we promote environmentally friendly product development based on the “Hitachi Group Eco-Design Management Guidelines” (revised version), which takes product life cycles into account.

Eco-design that takes product life cycles into account is now required by the revision of ISO 14001:2015, by the establishment of IEC 62430^{*1}, and by national regulations for energy-saving products. In order for evaluations to be made from the viewpoint of life cycles based on IEC62430, the Hitachi Metals Group revised its environmentally conscious design assessments and Life Cycle Assessment (LCA) in fiscal 2016. Using these assessment tools, we carry out product development and design that consider the environment throughout the entire life cycle of the product, from procurement and manufacturing to use and disposal by the customer.

The table below shows examples of the Hitachi Metals Group's products and the environment- and energy-related fields in which the products are utilized.



*1. IEC 62430: The standards set by the International Electrotechnical Commission (IEC) for “Environmentally conscious design for electrical and electronic products”

Examples of the Hitachi Metals Group's Products and the Environment- and Energy-Related Fields in Which the Products Are Utilized

Field of application			Products and development technologies
Energy	Renewables Energy	Solar cells	Amorphous cut core, dust choke coil, target materials
		Wind-power generation	Rare earth magnets, amorphous metal materials, fine met core, magnet wires
	Energy saving and high efficiency	Power generation facilities	Super-heat-resistant metal materials, precision casting blades for turbine wheels
		Home appliances	Magnets for air conditioners and refrigerator compressors High-efficiency amorphous motor components
	Electricity storage/transformation	Transformers	Amorphous metal materials for low-loss transformers
		Batteries	SOFC ^{*2} fuel cell parts (interconnector materials, heat-resistant parts) Electrode members for secondary batteries, clad metals, xEV battery cases
Mobility	Automobiles	Emissions control	Components that help clean exhaust gas
		Light weight	Lightweight undercarriage, magnets for EPS ^{*3} , various sensors
		High efficiency	Heat-resistant cast steel materials, CVT ^{*4} belt materials
	Hybrid/EVs	Motors	Rare earth magnets, amorphous metal materials, amorphous motors, fine met core, clad metals for secondary battery electrodes, highly efficient magnet wires
		Inverters and other devices	Members for fast charging, aluminum cast inverter cases, silicon nitride substrates, power harnesses
	Rolling Stock	More efficient, compact, lighter weight	Cables for rolling stock
	Aviation	Longer life and higher efficiency	Ni-based alloy large forged parts for aircraft engines, high-heat-resistance/high-corrosion-resistance alloys
All industries/Infrastructure	Industrial equipment, etc.	Aircraft components	Long-life die steel, carbide rolls, corrosion/heat-resistant fittings, Eco-Green cables Additive manufacturing technology
	Water treatment	Seawater desalination	Ceramics adsorption filters for pretreatment of seawater desalination
	Electronics	More efficient, compact, lighter weight	Communication modules, multilayer ceramics components, silicon nitride substrates

*2. Solid Oxide Fuel Cell; *3. Electronic Power Steering

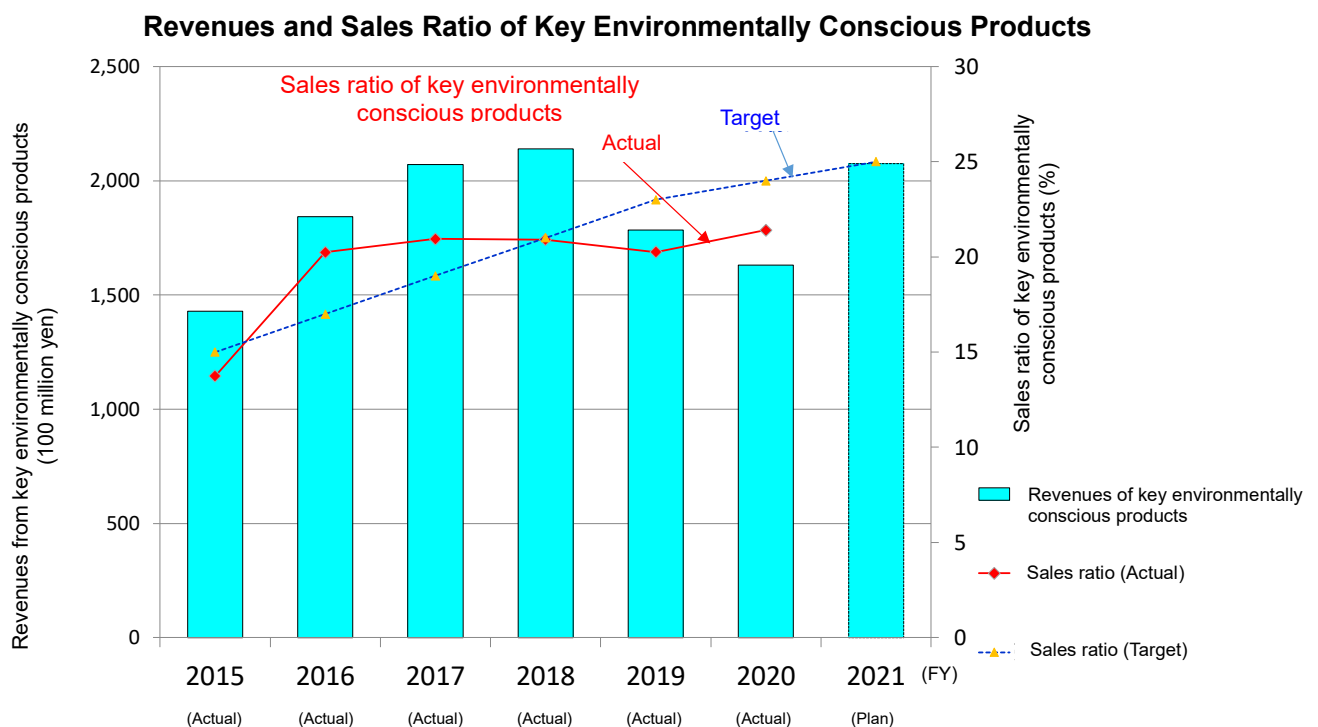
*4. Continuously Variable Transmission

(2) Expansion of Key Environmentally Conscious Products

The Hitachi Metals Group defines environment-conscious products as those targeted for growth based on a management strategy and that make a significant contribution to resolving environmental issues such as climate change and resource recycling. The Group is promoting the increase of revenue from environment-conscious products.

In fiscal 2020, revenues from sales of key environmentally conscious products declined by 15.5 billion yen year on year to 163 billion yen, chiefly due to production reduced globally as a result of the spread of COVID-19. The sales ratio of those products to the Company's total consolidated revenues increased 1.5% year on year to 21.2%, falling short of the target ratio of 24%.

Going forward, we will expand the lineup of target products and promote sales, aiming to contribute to solving environmental issues facing our society.

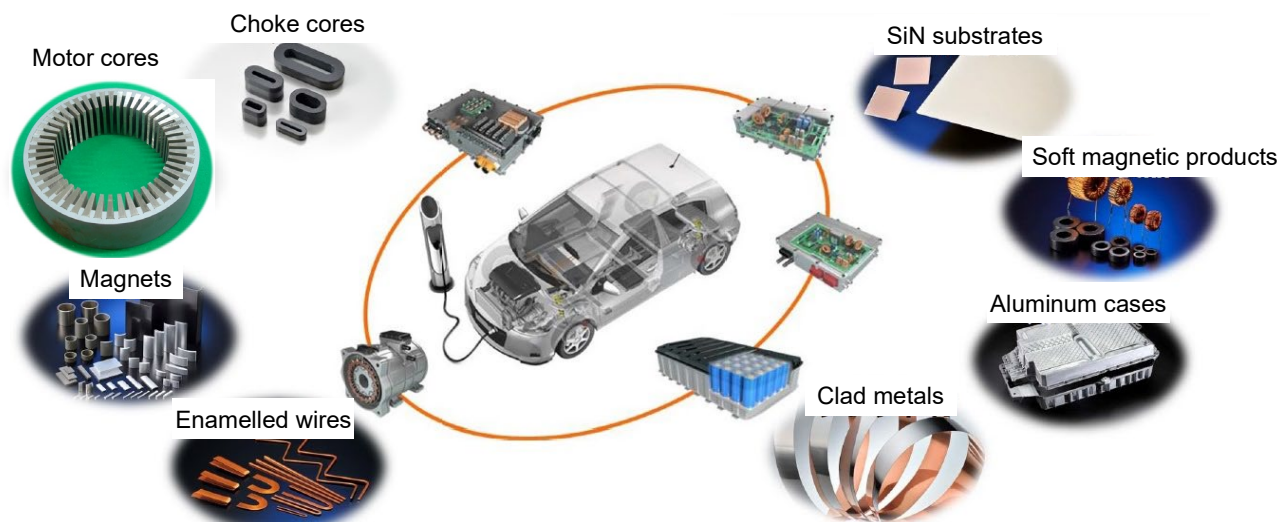


(3) The Hitachi Metals Group's Environment- and Energy-related Products

The Hitachi Metals Group develops and delivers materials and products in fields ranging from generators and transformers through to factories, plants, offices, homes, and vehicles, contributing to the environment and energy across wide-ranging areas of society.

[Introducing Environment- and Energy-related Products]

■List of our xEV*¹-related products

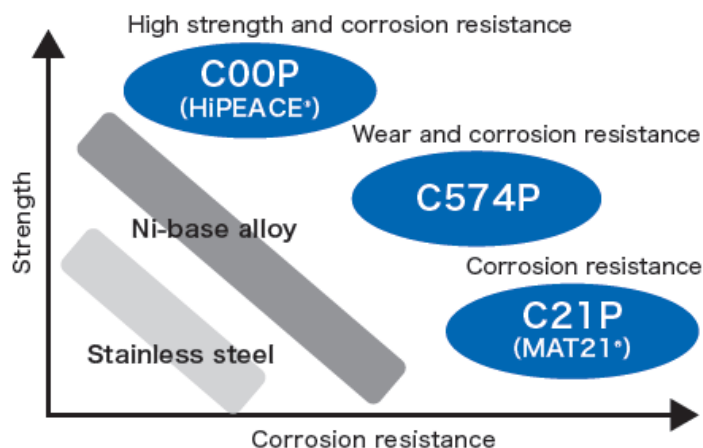


*1. xEV: A generic term for electric vehicles (EVs), hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles (PHEVs)

■Additive manufacturing technology (technological development)

**Global Research & Innovative Technology Center
AM Solution Center, Advanced Metals Division**

One major challenge facing plant facilities and equipment for use under highly corrosive ambient conditions, as particularly seen in mineral resources development projects, is to improve the corrosion resistance and strength of components at the same time. Hitachi Metals' ADMUSTER®C series offers three types of alloy powder materials (C00P, C574P, C21P) to be chosen according to the environment in which the equipment is to be operated, and our materials and manufacturing technologies can apply various modeling (3D printing) methods to achieve components with complex geometries. Our additive manufacturing technology can heighten the reliability and prolong the service life of components particularly for use in chemical plants and semiconductor manufacturing equipment.



Corrosion resistance and strength of alloy powder for additive manufacturing



Example of additive manufactured (3D printed) product (valve)

■New cold work die steel SLD®-f and SLD®-f60

Tool Steel Department, Specialty Steel Business Unit, Advanced Metals Division

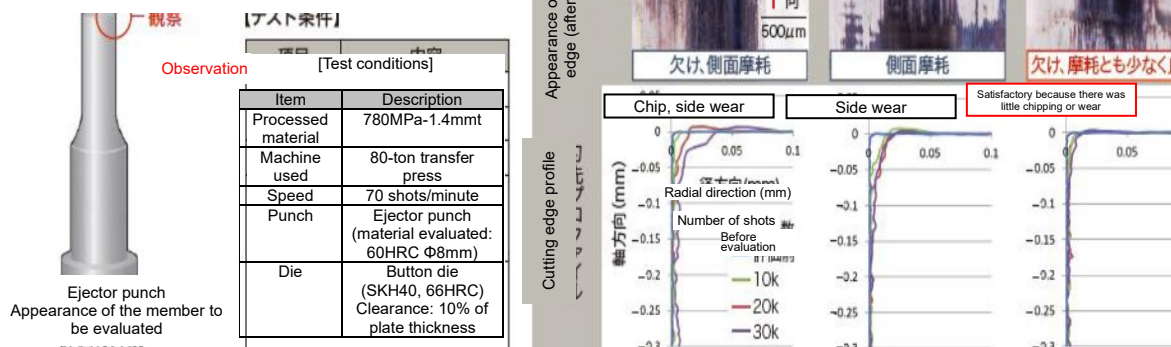
SLD®-f is a new cold work die steel product that can offer a constant hardness of at least 60 HRC, good toughness, and improved resistance to chipping. This steel exhibits reliable hardness even during high temperature tempering, thus helping reduce dimensional change resulting from PVD coating. Additionally, the composition and microstructure of steel has been studied so as to increase machinability, which has enabled higher cutting speed, thus effecting a shorter processing time.

SLD®-f60 offers engraving die materials that have been heat treated to achieve 60 HRC levels. You can eliminate the need for handling of complicated heat treatment processes, including for heat treatment and distortion correction, enabling simplified processes.

As stated above, SLD®-f and SLD®-f60 can help shorten mold processing time and mold production lead time, thereby contributing to effective use of resources.

Evaluation case

The evaluation of punch edge wear is satisfactory because there is little chipping or wear.



■NEOMAX® rare earth magnets for xEV drive motors and power generators

Magnetic Materials Business Unit, Advanced Components & Materials Division

Hitachi Metals led the world in developing and launching the mass production of NEOMAX® neodymium magnets. With the world's best magnetic properties, NEOMAX® magnets are used in the drive motors of xEVs and contribute to better fuel efficiency.

We have also developed and mass-produce a diffusion technology for heavy rare earth metals, the DDMagic® series, which increases heat resistance and magnetic force while reducing the amount of heavy rare earth elements (dysprosium [Dy], etc.) added to improve heat resistance in NEOMAX® magnets, and the F series, which uses technology to limit the use of heavy rare earth elements.

As energy conservation and the need for fuel efficiency lead to greater demand for rare earth magnets, rare metals (heavy rare earth elements in particular) are in limited supply. Hitachi Metals will support the shift to compact and higher performance motors, and thus contribute to the creation of a low-carbon, recycling-based society by manufacturing high-performance magnets while reducing the use of rare metals.

*1. xEV: A generic term for electric vehicles (EVs), hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles (PHEVs)



NEOMAX® Nd rare earth magnet

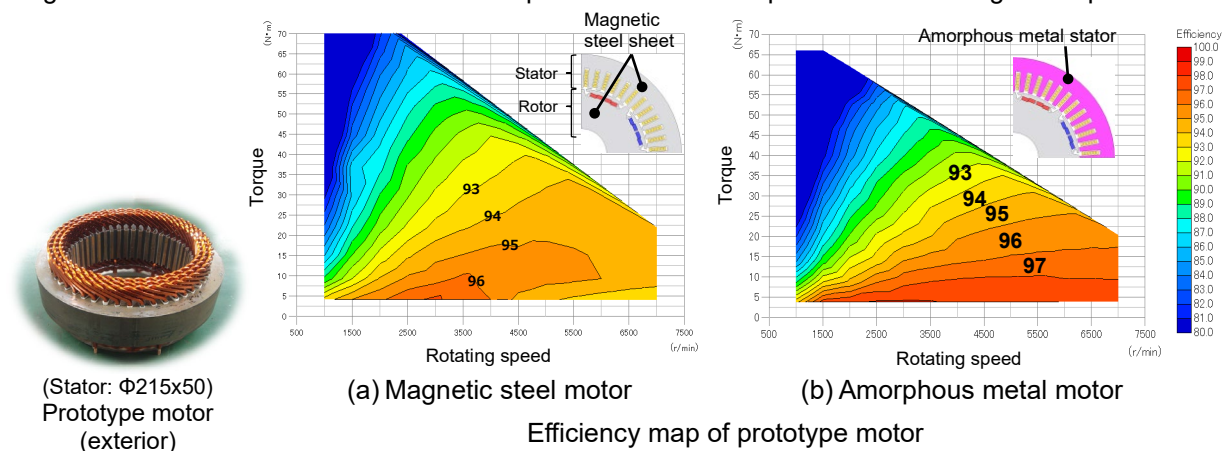
■Amorphous core for motors (technological development)

Global Research & Innovative Technology Center
Power Electronics Materials Business Unit, Advanced Components & Materials Division

It is said that motors consume 50% of the global supply of electric power, and as such, improving the efficiency of this mechanism is one of the most overriding issues of energy conserving technology. Looking to offer a solution to this, Hitachi Metals is working to adopt company-held low-loss amorphous materials to motor production.

In a recent demonstration test, a prototype with the size of a vehicle drive motor has achieved an about 3% improvement in efficiency. Also, it was confirmed that using amorphous materials for the stator in place of the standard magnetic steel sheet can reduce iron loss by 80%.

Generally, the iron loss of the motor increases as its rotating speed rises, posing a major inhibitor of maximum power output. A solution to this limitation will be provided by adopting amorphous materials with high iron efficiency, which can achieve high rotation drive, a level impossible with the motor employing magnetic steel sheet. This measure also helps enable more compact motors with higher output.

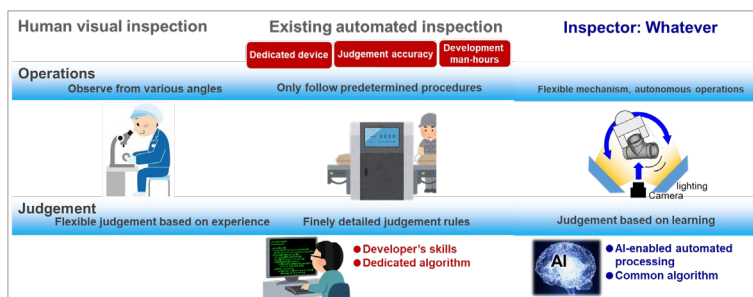


■Autonomous visual inspection system & solution (technological development)

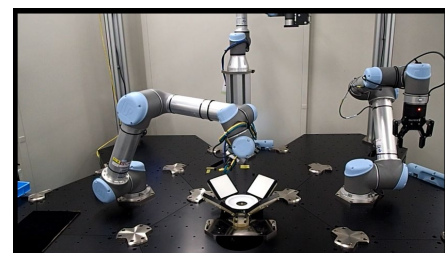
Global Research & Innovative Technology Center

Existing automated visual inspection processes involve human operators to command the robot to perform specific tasks and create image recognition programs for each product to be inspected, requiring a substantial time and workload. In the meantime, manufacturers are facing the need to increase production capacity while reducing cost and time for skills development, in order to compete successfully in global markets. Aiming to address this situation, Hitachi Metals started to develop more effective automation technologies for visual inspection to eliminate the need for human intervention into robotic operations. However, there were a host of challenges to overcome to realize automation technologies to exhibit high levels of versatility and precision at once to be able to handle a broad spectrum of products.

To deal with these challenges, we leveraged our production technologies while also promoting DX and open innovation initiatives, which resulted in the development of Nandemo Inspector™, autonomous visual inspection system and solutions. We have recently carried out a principle verification test for the above-stated concept, and launched an operational demonstration. The relevant development process is advancing toward mass production in cooperation with partners.



Development concept of Nandemo Inspector™



Model system (exterior)