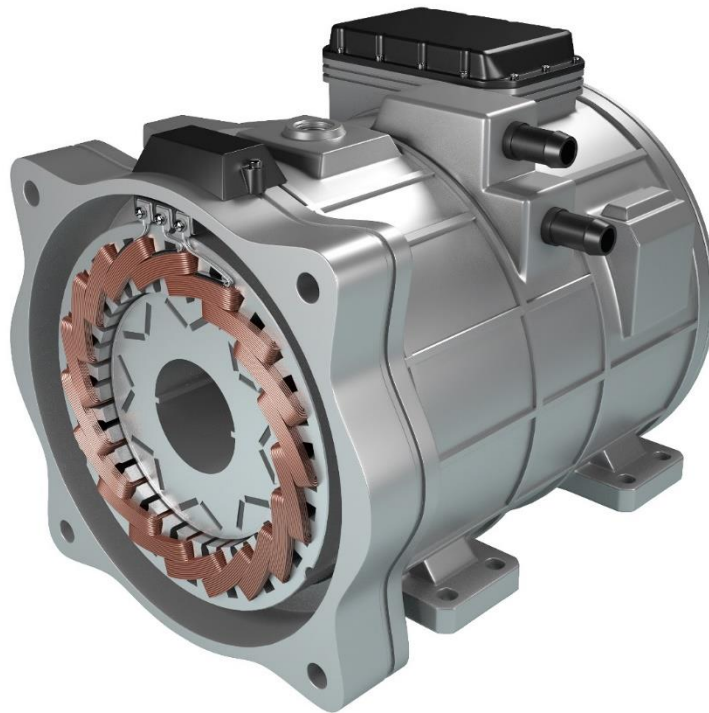


Magnetic Materials and Components by Proterial



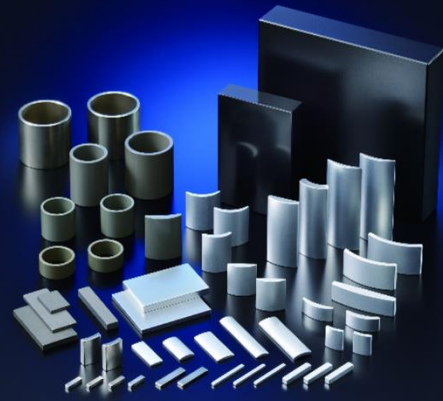
- Nd-Fe-B Magnets NEOMAX® with Heavy Rare-earth Reduction Technology
- Nd-Fe-B Magnets NEOMAX® with Heavy Rare-earth Free Technology
- Nd-Fe-B Anisotropic Ring Magnets
- High-performance Ferrite Magnets NMF™-12, 15 Series
- Permendur YEP™-2V
- Amorphous Alloy for Motor
- FINEMET® Common Mode Choke Coils/Cores
- Magnetic Shield Sheet for Noise Reduction
- Shield Yoke Sheet MS-HiQ Series for Wireless Chargers
- Low Core Loss Cut Cores F3CC Series and Non Cut Core FT-3TL for Medium Frequency Transformer
- Magnetic Slot Wedge for Motor Application

July 2025, Proterial, Ltd.

NEOMAX, NMF, YEP, MaDC-F, and FINEMET are registered trademarks or trademarks of Proterial, Ltd.

**Achieve high performance
and resource risk reduction**

Nd-Fe-B Magnets NEOMAX[®] with Heavy Rare-earth Reduction Technology



Features

- High remanence (B_r) and coercivity (H_{cJ})
- Significant reduction of heavy rare-earth*
- Reduction of coercivity distribution in an individual magnet*

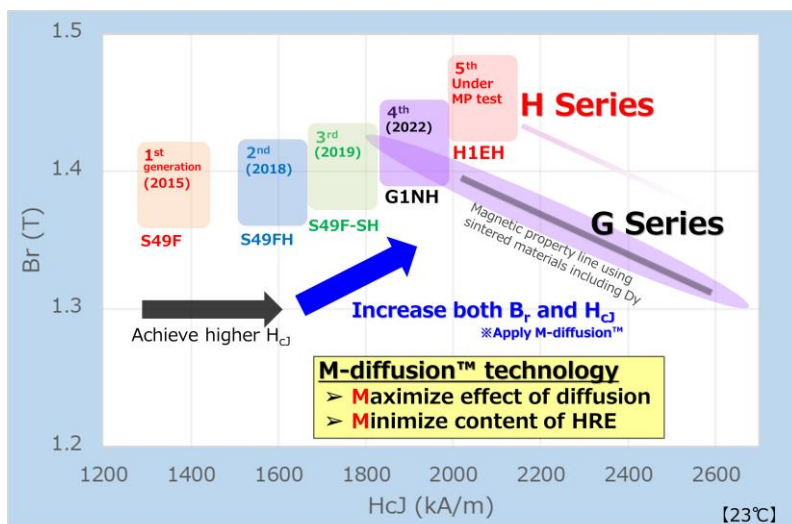
**Compared to our conventional diffusion process

Applications

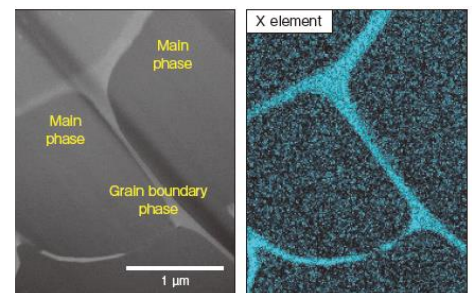
- Motor
- Actuator
- Generator

■ Magnetic properties with "M-diffusionTM"

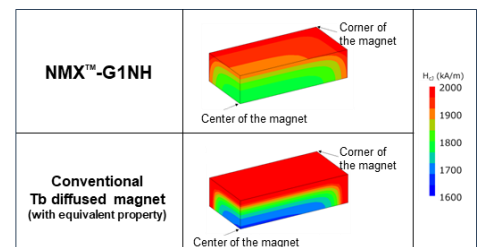
Achieve both reduction of resource risk and high performance by applying Proterial's original technology "M-diffusionTM".



■ Example of microstructure and X-element distribution



■ Simulation example of coercivity distribution within the magnet



- Dimension of the magnet: 5(easy magnetization direction)×10×20 (mm)
- Calculation about one-eighth region of the magnets using actual magnetic properties

※Examples of calculations and does not guarantee these properties.

* NEOMAX, M-diffusion and NMX are registered trademarks or trademarks of Proterial, Ltd.

Achieve high performance and reduce risk of supply chain shortages

Nd-Fe-B Magnets NEOMAX® with Heavy Rare-earth Free Technology



Features

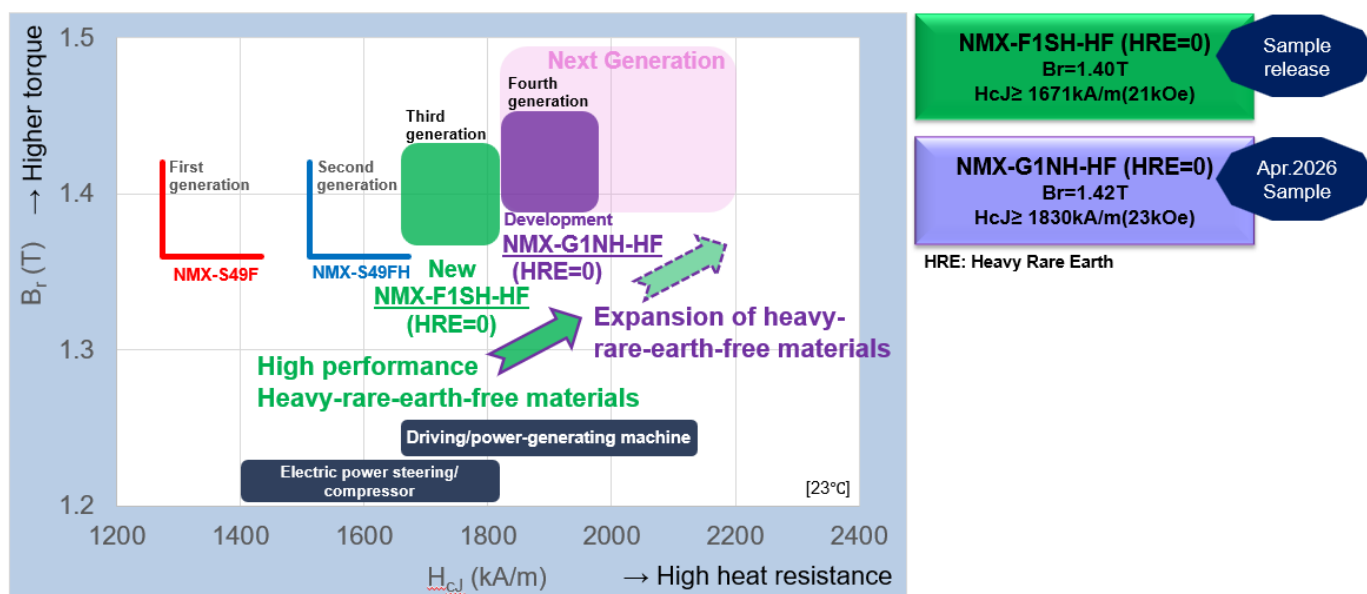
- No use of heavy rare-earth elements
- High remanence (B_r) and coercivity (H_{cJ})
- Suitable for EV traction motors and generators

Applications

- Motors
- Actuators
- Generators

Magnetic properties of heavy rare-earth free magnets

Achieve heavy rare earth free composition and high performance by controlling impurities through Proterial's unique manufacturing method and refined process design.



* These are representative values and do not guarantee specific characteristics.

* NEOMAX and NMX are registered trademarks or trademarks of Proterial, Ltd.

Inquiry

Proterial, Ltd.

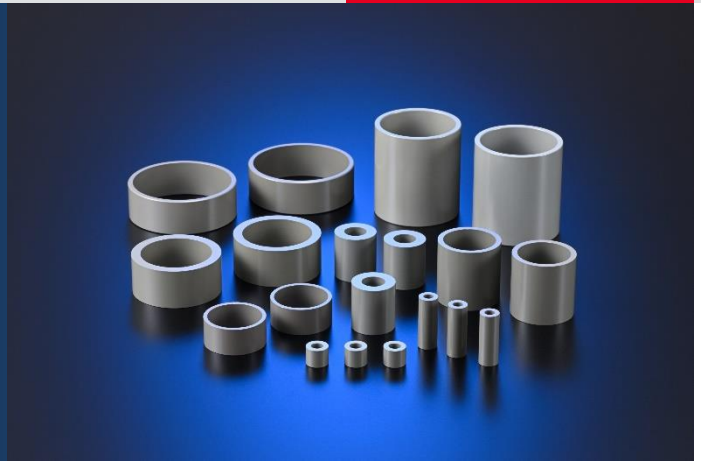
Magnetic Materials Business Unit

Toyosu Prime Square 5-6-36 Toyosu, Koto-ku, Tokyo 135-0061, JAPAN

The characteristic values, photographs, charts, rankings, evaluations, etc. shown in this catalog are representative values based on our test data and do not guarantee the quality of the products. The information in this catalog is subject to change without notice.

Enhancing performance of motors and assembly optimization

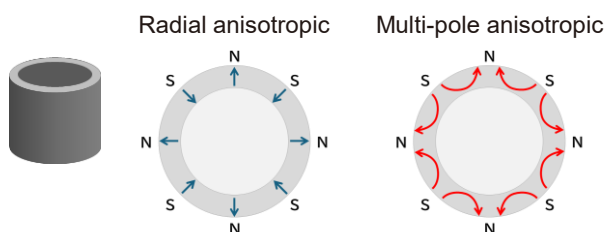
Nd-Fe-B Anisotropic Ring Magnets



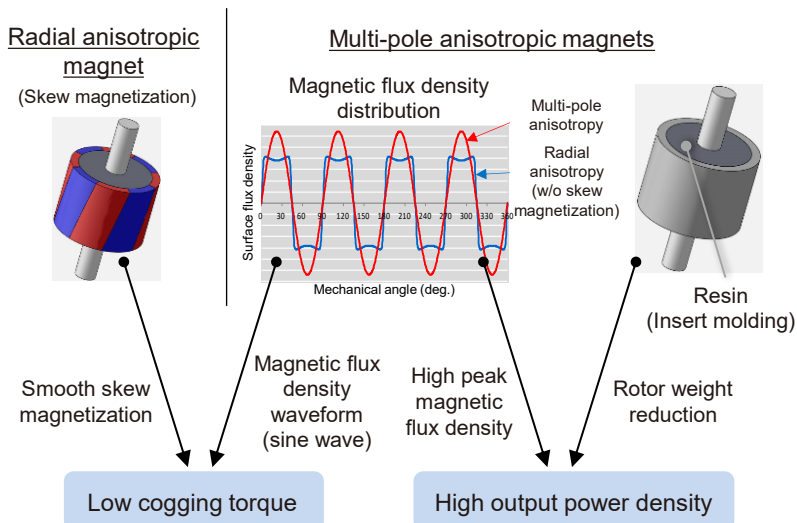
Benefits

- Reduction of assembly processes
- Increase output density (High power output and weight reduction)
- Reduce cogging torque

■ Magnetic flux distribution within the magnets (Schematic illustration)



■ Contribution to motor performance increase

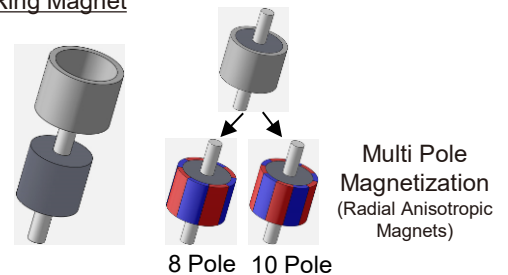


Applications

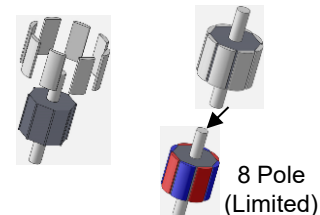
- Motors
- Actuators

■ Contribution to reduction of assembly processes

Ring Magnet



(Ref.) Segment Magnets



The number of poles illustrated in this document are representative examples. For more details, please contact us.

Proposed for typically rare-earth magnet applications

High-performance Ferrite Magnets NMF™-12 & 15 Series



Features

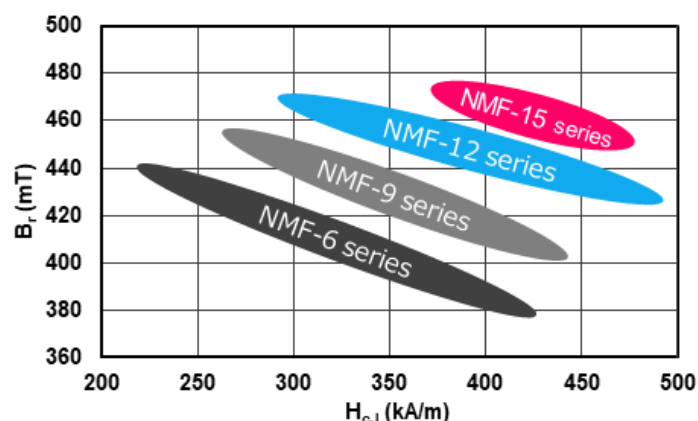
- Highest-level of magnetic properties among mass-produced ferrite magnets (as of April 2025)
- Suppressing generation of eddy currents due to resistivity three orders of magnitude higher than that of rare-earth sintered magnets

Applications

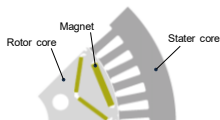
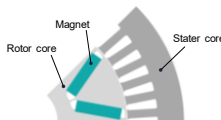
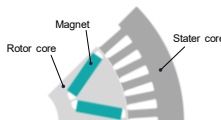
- Motor

■ Magnetic properties of NMF™ series

Lineup up to the NMF™-15 series with the world's highest-level of magnetic properties among mass-produced ferrite magnets.



■ Example of simulation results for traction motors

	Reference (Using Rare-earth Magnets)	Proposal ① (Equivalent Motor Performance)	Proposal ② (Equivalent Motor Size, High Speed Rotation)
Magnets in simulation	Rare-earth Magnets	High performance Ferrite magnets NMF™-15 series	High performance Ferrite magnets NMF™-15 series
Motor model "1/8"			
Max. Output	110 kW	110 kW	105 kW
Max. Rotation Speed	10,000 rpm	10,000 rpm	15,000 rpm
Magnet B _r (relative value)	1.0 (ref.)	0.37	0.37
Magnet Weight (relative value)	1.0 (ref.)	1.7	1.2
Motor Length (relative value)	1.0 (ref.)	1.4	1.0
Motor Weight (relative value)	1.0 (ref.)	1.3	1.0

* NMF is a trademark of Proterial, Ltd.

Achieving a Compact, Lightweight, and High-Power Motor

Permendur YEP™-2V



Overview

YEP™-2V (Fe-49Co-2V in mass%) has high saturated magnetic flux density, which realizes compact, lightweight, high-power motors and high responsive actuators.

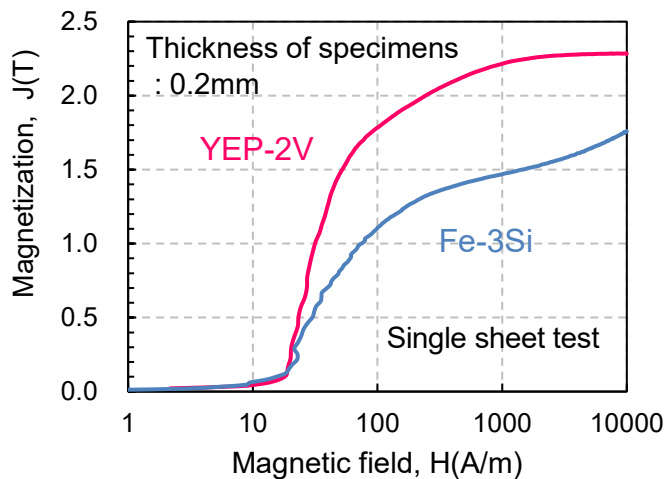
Applications

Motor core
Actuator core

Technology Features

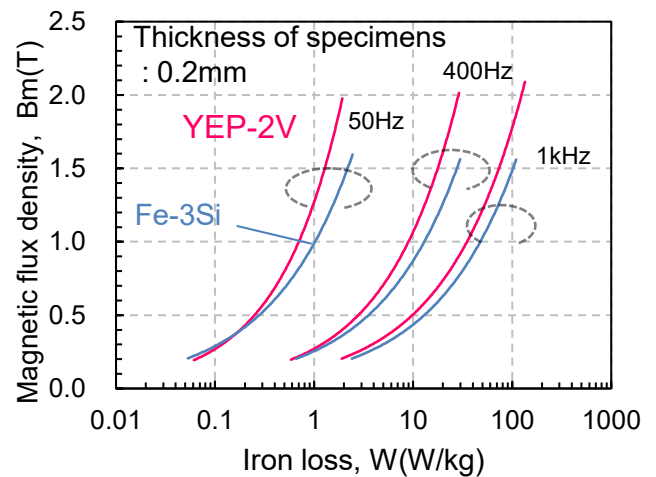
■ Initial D.C. magnetization curve

YEP-2V shows higher magnetization than Fe-3mass%Si steel.



■ Iron loss curve

YEP-2V shows smaller iron loss than Fe-3mass%Si steel.



■ Example of laminated core



■ Segmented core (laser welding)



YEP is registered trademarks or trademarks of proterial, Ltd.

Inquiry | **Proterial, Ltd.**

Industrial Materials Dept.
Specialty Steel Business Unit
Toyosu Prime Square 5-6-36 Toyosu, Koto-ku, Tokyo 135-0061, JAPAN

The characteristic values, photographs, charts, rankings, evaluations, etc. shown in this catalog are representative values based on our test data and do not guarantee the quality of the products. The information in this catalog is subject to change without notice.

Achieving a Compact, Lightweight, and High-Power Motor

Permendur YEP™-2V

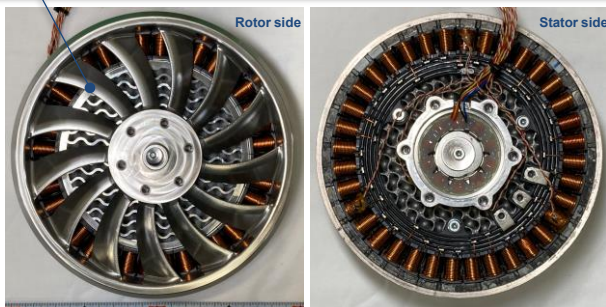


Overview

YEP™-2V (Fe-49Co-2V in mass%) has high saturated magnetic flux density, which realizes compact, lightweight, high-power motors and high responsive actuators.

Motor demonstration evaluation

Core Aluminum material 3D molding for the stator fixing part Gyrold structure improves cooling efficiency



eVTOL Simulated Outer Rotor Motor

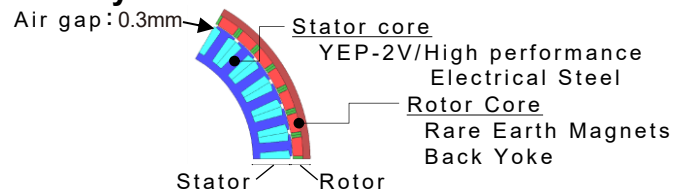
Applications

Motor core
Actuator core

Motor Specifications *1

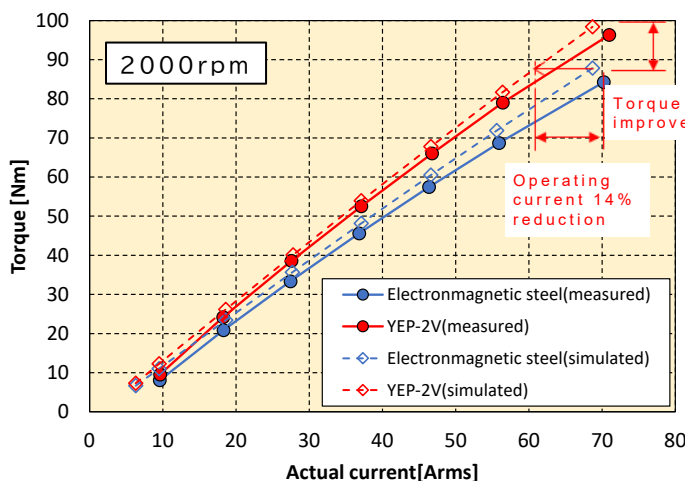
Motor structure : eVTOL Simulated Outer Rotor
Number of position : 42
Core Material : YEP-2V High-performance electromagnetic steel
High-Material Thickness : 0.1mm
Core Dimensions : OD150mm x Thickness35mm
Output : 15kW [torque : 70Nm] (using YEP-2V)
Rate speed : 2000rpm
Magnet : Rare Earth Magnets / Halbach array
Cooling method : Air-cooled
(*1 : Yamada Power Unit Co., Ltd. Design & Evaluation)

Analysis Model <1/6>

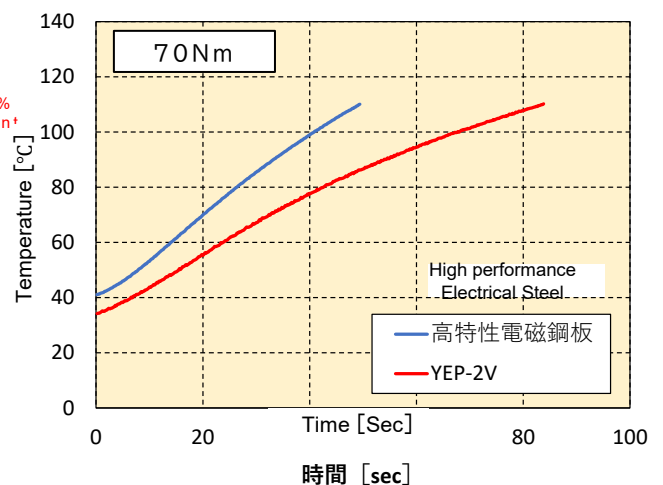


Motor Evaluation Results (Actual measurement)

YEP-2V can drive motors with 14% higher torque at the same current, and 14% lower current at the same torque



YEP-2V generates less heat and low temperature rise due to its high torque and low current drive



YEP is registered trademarks or trademarks of proterial, Ltd.

Inquiry

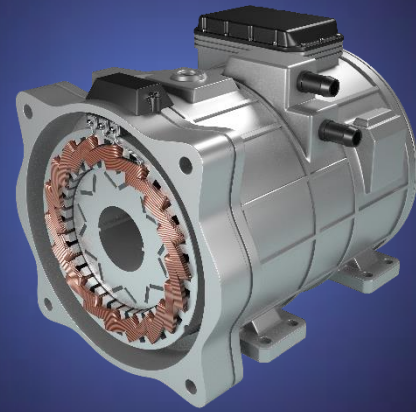
Proterial, Ltd.

Industrial Materials Dept.
Specialty Steel Business Unit
Toyosu Prime Square 5-6-36 Toyosu, Koto-ku, Tokyo 135-0061, JAPAN

The characteristic values, photographs, charts, rankings, evaluations, etc. shown in this catalog are representative values based on our test data and do not guarantee the quality of the products. The information in this catalog is subject to change without notice.

Realization of High-Efficiency Motors for Higher RPM

Amorphous alloy for motor



Overview

- Iron loss reduction with the amorphous core achieve the following effects to the motor.
- Energy saving by improving motor efficiency
- Reduction of thermal generation.

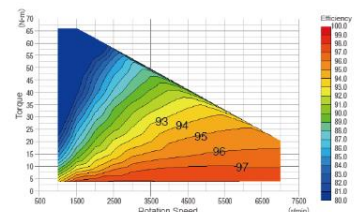
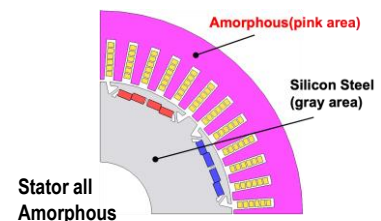
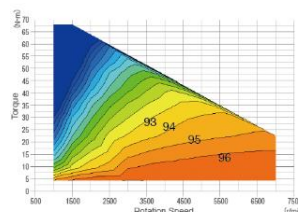
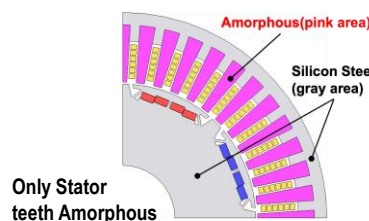
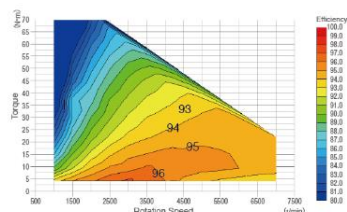
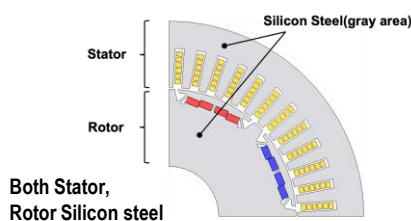
Technology Features

- Confirmed the following with an amorphous stator core.

- Iron loss reduced to about 1/5
- Efficiency improvement of 3% or more in the high rpm range
- Motor heat generation can be reduced by half

Note: evaluated loss of IPM motor (Φ215mm × 50mm stator core)

- Efficiency Comparison of prototype motor

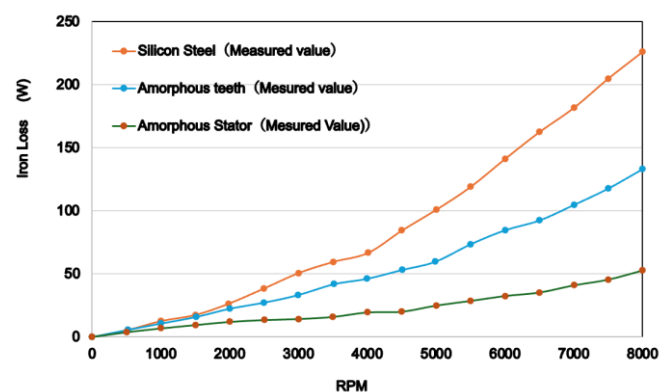


References: Yuji Enomoto, Mamoru Kimura, Yasuhiro Marukawa, Hirohisa Sano, "Distributed winding IPM motor with an entire stator core made of amorphous metal," Proceedings of the 2021 Industrial Applications Division Conference of the Institute of Electrical Engineers of Japan, 3-4, ppIII-133-138 (2021)

Applications

Low Load・High rotation speed Motor

- Iron loss evaluation result of prototype motor



Contribute to Downsizing of the Noise Filter

FINEMET® Common Mode Choke Coils/Cores



Overview

- High impedance at wide frequency range.
- Stable impedance under wide temperature range required for automotive parts.

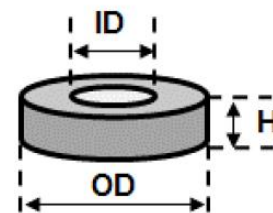
Applications

- On board charger for xEV,
- Inverter for xEV, etc.

Technology Features

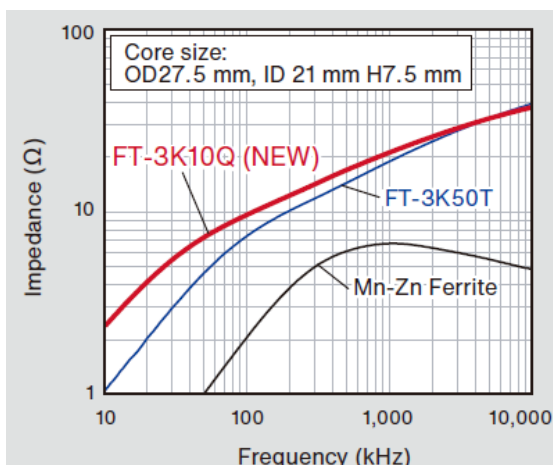
■ Comparison of "FT-3K10Q" with conventional materials

Material	impedance (Ω)		
	10kHz	100kHz	1MHz
FT-3K10Q	2.32	9.57	21.05
FT-3K50T	1.02	7.31	18.72
Mn-Zn Ferrite (Our material MP70D)	0.19	2.05	6.73

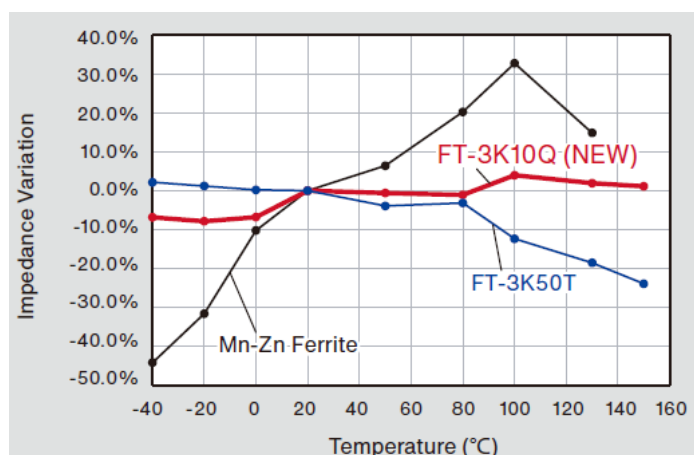


Core size:
OD27.5 mm, ID 21 mm H7.5 mm

■ Frequency characteristics of impedance

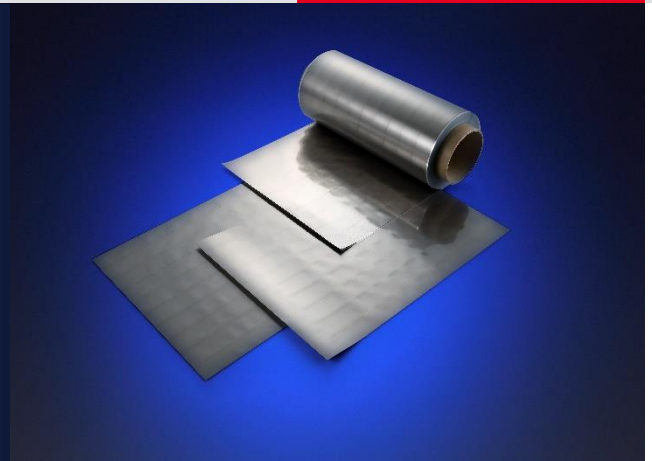


■ Temperature dependence of impedance



Heat Resistance Temperature of 130°C

Magnetic shield sheet for noise reduction



Overview

A thin, lightweight, flexible, and easy-to-handle magnetic shielding sheet made FINEMET® FT-3 with protective film.

Applications

Measures against magnetic noise inside xEV

Technology Features

■ You can select the suitable product from two types: a standard specification product and a high heat resistant product with a heat resistance temperature of 130°C.

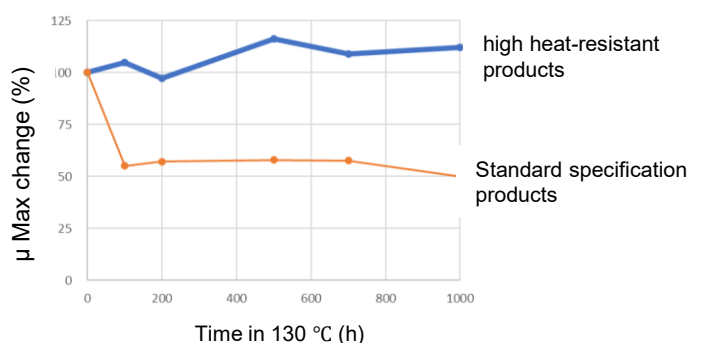
- Compared to standard specification products, high heat resistant products do not deteriorate in characteristics even in environments with temperatures of 130°C.
- The high heat-resistant product is thin at 0.05 mm (40% compared to conventional products), so it can be used even in narrow spaces.
- It easy to process into curved surfaces and various shapes.

Characteristic

Type	Standard specification products		Highly heat-resistant products	
Dimension	470mm x 100m	460mm x 610mm	470mm x 100m	460mm x 610mm
P/N	MS-FR 470-100M-T0	MS-F SD-460x610-T0	MS-FHR 470-100M-T0	MS-FH SD-460x610-T0
Thickness	0.13 mm		0.05 mm	
Magnetic flux density B ₈₀₀ (DC H=800A/m)	≥ 1.1T			
Maximum permeability, μ max (DC)	≧ 70,000			
Operating Temperture range	-40 ~ +80 °C		-40 ~ +130 °C	

Characteristic comparison

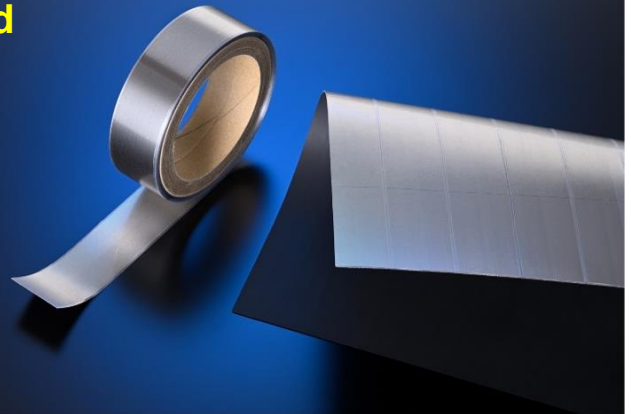
- Ideal for measures against noise in high-temperature environments such as automotive
- Contributing to the miniaturization and weight reduction of electronic devices, etc.



Comparison of μmax rate of change after 130°C storage

Shield Yoke Sheet with both Low Loss and High Magnetic Permeability

Shield Yoke Sheet MS-HiQ series for Wireless Chargers



Overview

Started supplying samples of the MS-HiQ series, which improved the Q value of conventional products by controlling magnetic permeability.

Applications

Thin and light shield yoke sheet

Technology Features

- Magnetic permeability control significantly improves the Q value of the conventional MS series
- It has excellent flexibility and impact resistance and achieves high mechanical reliability.
- Excellent workability (cutting, punching, etc.)
- With the high saturation magnetic flux density (1.23T), it is possible to reduce the thickness and weight of the sheet.
(50% thinner and 35% lighter than Mn-Zn ferrite (our company's ML29D: 0.54T))

Characteristics

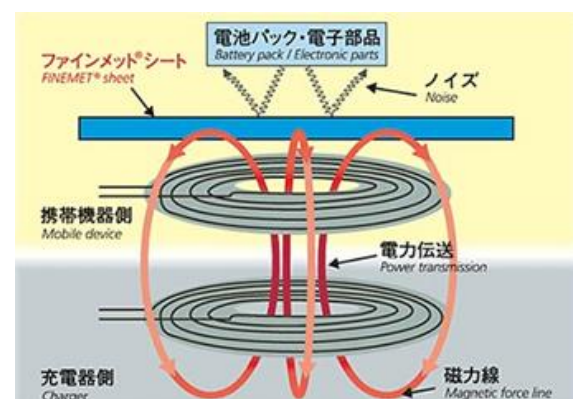
Coil Characteristics

25% improvement in Q value compared to conventional MS series, contributing to improved charging efficiency and reduced heat generation

Item	permeability	Ls (μ H)	Rs (m Ω)	Q
Coil	-	1.0	71.0	7.7
MS-HiQ series	(a)	5.6	48.0	62.6
	(b)	5.2	40.1	68.5
	(c)	5.2	38.7	71.5
MS series	13000	5.7	61.8	49.7

Measurement conditions: f=85kHz, V=0.03V

Schematic diagram of a wireless charging system



Contributing to Lower Loss, Smaller Size, and Lighter Weight

Low Core Loss Cut Cores F3CC series and Non cut core FT-3TL for Medium Frequency Transformer



Overview

F3CC and FT-3TL have both high magnetic flux density $B_s=1.23$ T and low core loss. Achieves smaller, lighter, and more efficient high-frequency transformers.

Applications

- Extreme fast charger
- Isolated Alternative power conditioner
- Aux power supply of train

Technology Features

■ Characteristic comparison with conventional material Mn-Zn ferrite Si-Fe

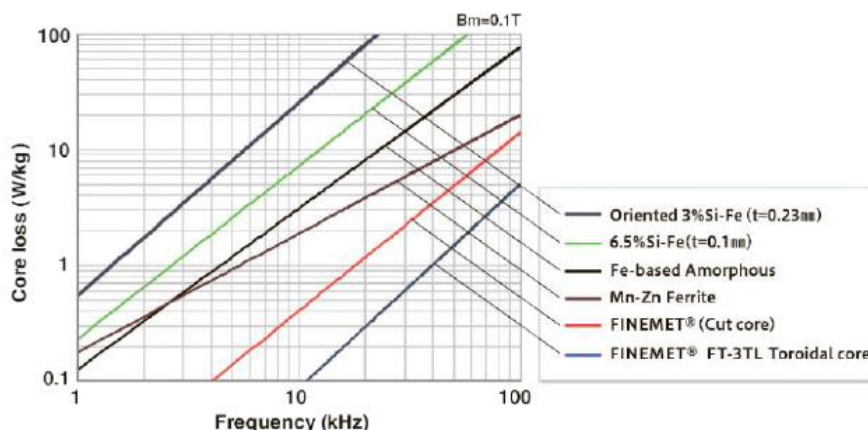
Materials	B_s (T)	P_{cm} (W/kg)	λ_s (ppm)	T_c (deg C)
FINEMET®F3CC	1.23	0.4	~0	570
FINEMET®FT-3TL	1.23	0.1	~0	570
Mn-Zn Ferrite	0.53	2.0	-0.6	230
3% Si-Fe	1.90	25	8	750

(P_{cm} : 10kHz0.1T)

■ 20kHz 100kVA MFT example



■ Comparison of core loss frequency characteristics of various cores



Significantly Improved Permeability, Strength, and Heat Resistance

Magnetic slot wedge for motor application



Overview

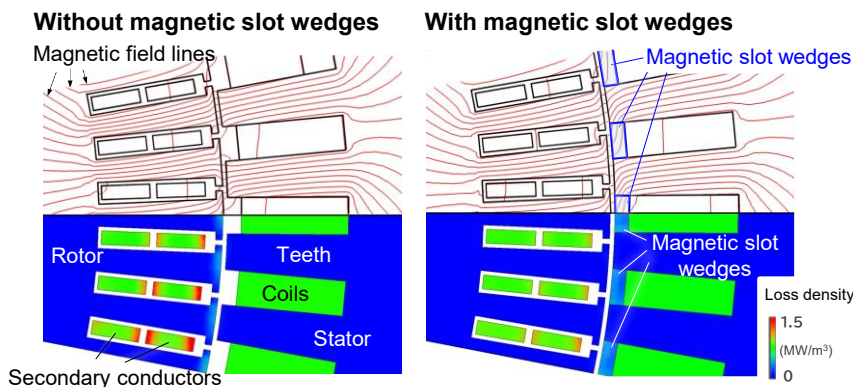
Our resin-less magnetic slot wedges, which are high-density compacted powders, contribute to higher motor efficiency with high magnetic permeability, high strength, and high heat resistance compared to conventional resin magnetic slot wedges.

Applications

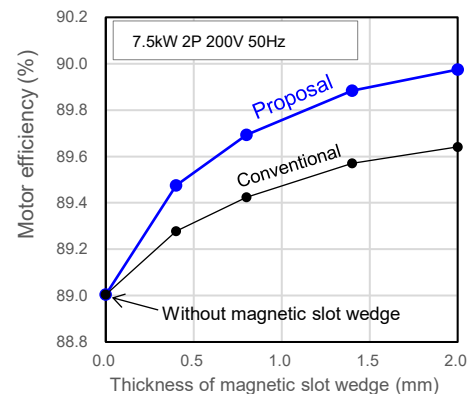
Various motors

Technology Features

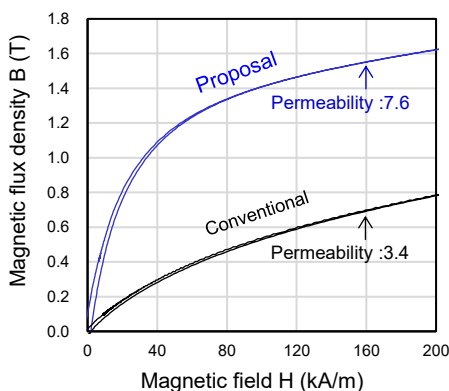
■ Broadening magnetic flux distribution reduces losses on the rotor surface.



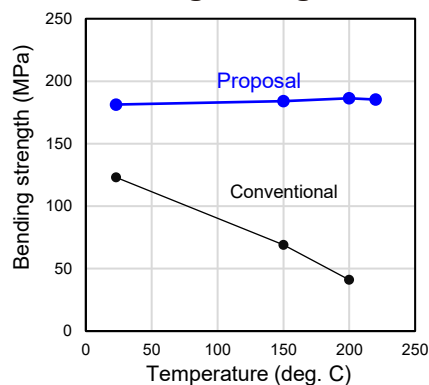
■ Simulated motor efficiency.



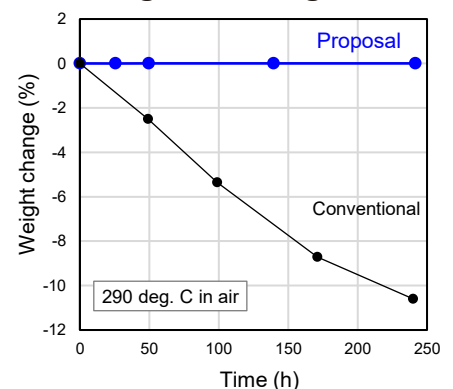
■ D.C. magnetization curves.



■ Temperature dependence of bending strength.



■ Weight reduction during heating at 290 deg. C.



**Proterial, Ltd.
Official Website**



**Proterial, Ltd.
LinkedIn
Official Account**



Proterial, Ltd.

<https://www.proterial.com/e/>

Toyosu Prime Square, 5-6-36 Toyosu, Koto-ku, Tokyo 135-0061, Japan