

December 9, 2022  
Hitachi Metals, Ltd.

## Proposing High-Performance Ferrite Magnets for xEV Traction Motors

**Hitachi Metals, Ltd. (hereinafter “Hitachi Metals”) has verified in simulations that by optimizing the design of motors that use our high-performance ferrite magnet NMF<sup>®</sup> 15 (hereinafter “ferrite magnet motors”), they are able to achieve the same level of output as traction motors for xEV<sup>\*1</sup> that use neodymium magnets. Ferrite magnet motors do not use neodymium, a rare earth element, or dysprosium or terbium, resources which are particularly limited in quantity. As such, they are expected to reduce resource risks and costs in addressing the growing demand for xEVs. Hitachi Metals now proposes high-performance ferrite magnets in addition to neodymium magnets for use in xEV traction motors.**

### 1. Background

In order to realize carbon neutral, decarbonized societies, xEVs are expected to account for an ever-increasing percentage of vehicle production going forward. This is expected to lead to an increase in production of neodymium magnets used in traction motors and generators for xEVs. That being said, neodymium magnets use not only neodymium, which is classified as a light rare earth among rare earths, but also dysprosium and terbium, which are heavy rare earths which are particularly limited in quantity as resources. As such, there are concerns that resource risks will increase as demand grows.

In addition to focusing on improving the characteristics of neodymium magnets, which lead to smaller and lighter motors for xEVs, Hitachi Metals has also been reducing the amount of heavy rare earths used and improving recycling technology to enhance material flows (to reduce the purchase and use of rare earths).

Against this backdrop, the Global Research & Innovative Technology center (GRIT) at Hitachi Metals has been studying the application of ferrite magnets in traction motors for xEVs as a new approach to mitigate resource risks.

### 2. Overview

Hitachi Metals has recently conducted a simulation to optimize the design of motors based on the idea of applying our NMF<sup>®</sup> 15 high-performance ferrite magnets in xEV traction motors. In terms of magnetic properties, these magnets deliver the world's highest levels among ferrite magnets. As a result, we have verified that by optimizing the mounting positions and size of the magnets, ferrite magnet motors can be made to achieve the same level of output as a motor using a neodymium magnet under certain conditions<sup>\*2</sup> as shown in the following design example.

High-performance ferrite magnets used [1]: 30% increase in motor weight, with equivalent output level  
High-performance ferrite magnets used [2]: Equivalent weight and output levels achieved by increasing rotation speed by 50%.

## Examples of xEV traction motor designs

	Nd-Fe-B magnets used (Basis of comparison)	High-performance ferrite magnets used [1] (Equivalent motor performance)	High-performance ferrite magnets used [2] (Equivalent motor size and higher rotation speed)
<b>Motor : "1/8 model"</b>  <span style="color: #0056b3;">■</span> Nd-Fe-B magnets <span style="color: #00a68d;">■</span> High-performance ferrite magnets NMF™ -15G			
<b>Max. output</b>	110 kW	110 kW	105 kW
<b>Max. rotation speed</b>	10,000 rpm	10,000 rpm	15,000 rpm
<b>Thickness in axial direction</b>	1 (ref.)	1.4	1.0
<b>Magnet B<sub>r</sub></b>	1 (ref.)	0.37	0.37
<b>Magnet weight</b>	1 (ref.)	1.7	1.2
<b>Motor weight</b>	1 (ref.)	1.3	1.0

\*Designed for fixed rotor and stator diameters, taking into account operating temperatures and strength at high speeds.

The results of the simulation show that ferrite magnets can potentially be used in high output motors such as those used to traction xEVs. Spurred by these results, Hitachi Metals now proposes high-performance ferrite magnets as an option for various applications where neodymium magnets have been used in the past to help customers achieve objectives such as resource risk reduction and cost containment.



Photo: NMF® series ferrite magnets

Hitachi Metals is a general manufacturer of motor materials, and offers not only neodymium and ferrite magnets, but also amorphous metals for cores (iron cores), enameled wires, magnetic wedges, and other materials that realize higher performance and efficiency in motors. We will contribute to the realization of carbon-neutral, decarbonized societies by providing a variety of motor materials while offering solutions to our customers' motor-related issues.

\*1: General term for electric vehicles (EVs), hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles (PHEVs)

\*2: These are results of simulations performed using a comparable motor. Results may vary depending on the motor.

End of report

## ■ About the new trade name PROTERIAL

Hitachi Metals, Ltd. will change its trade name to Proterial, Ltd. on January 4, 2023.

# PROTERIAL

“Proterial” reflects the essence of our corporate philosophy, which consists of three elements: Mission: “Make the best quality available to everyone;” Vision: “Leading sustainability by high performance;” and Values: “Unflinching integrity” and “United by respect.” It combines “pro-” with the word “material.”

“Pro-” represents our “three pros”:

- Professional — work that exceeds expectations
- Progressive — a spirit that keeps challenging
- Proactive — an enterprising attitude

“Material” refers to the high-performance materials that our original technologies produce and 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.

## ■ Movie introducing our new company name "PROTERIAL"

<https://www.youtube.com/watch?v=hxknM07TxUg>

Click here for movie

