

Magnetic Powder Core process optimization system

Quantified prototype conditions and AC losses and proposed design guidelines

Overview

Magnetic Powder Cores, possessing both high saturation magnetic flux density and high degree of shape freedom, are widely used as core materials for motors, transformers, and other applications. However, increased losses in the high-frequency range are a challenge for Magnetic Powder Cores, necessitating the development of design guidelines for reducing losses.

Conventional Magnetic Powder Cores design often relied on experience and intuition, but in recent years, machine learning-based AC loss estimation methods and mechanism analysis methods have been proposed, leading to increased accuracy in material design. Nevertheless, Magnetic Powder Cores have numerous design parameters, and optimizing process conditions, in particular, has been difficult.

The present invention constructs an estimation system that accurately predicts AC losses when prototype conditions are input, by utilizing Lasso regression and dividing the dataset into multiple parts. By appropriately modifying the prototype conditions according to the prediction function obtained in this invention, it can be used to develop design guidelines for Magnetic Powder Cores.

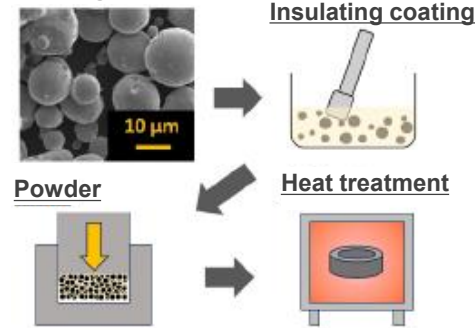
Product Application

- Optimization of Magnetic Powder Core process conditions
- Development and design of Magnetic Powder Core
- Circuit/material co-design

IP Data

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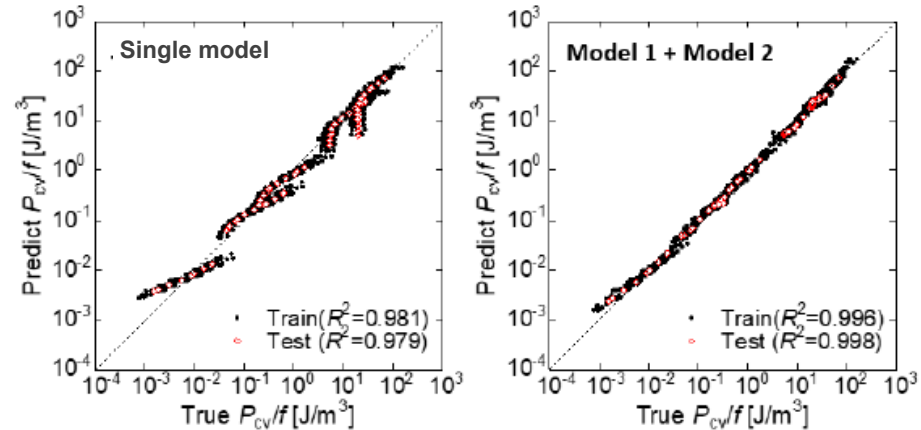
Soft magnetic particles



The relationship between prototype conditions and AC losses is quantified by **Lasso** regression.

Multiple models enable highly accurate prediction of AC losses

◆ Comparison of measured values and predicted values



Related Works

[1] S. Muroga, S. Matsumoto, Y. Kodama, S. Ajia and Y. Endo, "Segmented Linear Regression Modeling for Interpretable AC Core Loss Prediction in Magnetic Powder Cores," IEEE Trans. Magn., doi: 10.1109/TMAG.2026.3698191 (2026)

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