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Guide for magnetizing behaviour of permanent magnets

永磁体磁化行为指南

(English Translation)

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Foreword

This document is a standard or guiding technical document.

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents". Drafting.

This document is equivalent to IEC TR62517:2009 "Magnetic behavior of permanent magnets".

This document adds two chapters. "Normative References" and "Terms and Definitions".

The following minimal editorial changes have been made to this document.

---In order to comply with the naming requirements of national standardization guiding technical documents, the standard name has been changed to "Guideline for Magnetization Behavior of Permanent Magnets".

Introduction

This document aims to describe in detail the magnetization behavior of permanent magnets. First, Chapter 4 discusses the relationship between the applied magnetic field strength and the effective internal magnetic field strength.

The relationship between the two is discussed; secondly, Chapter 6 focuses on the magnetization behavior of all common permanent magnets, and divides it into three parts based on the formation mechanism of coercivity.

The components include sintered ferrites with nucleation mechanisms, RE-Fe-B and SmCo₅, carbon steel and Sm₂(Co,Fe,Cu,Zr)₁₇ with pinning mechanisms, and single-magnetic materials.

Nanocrystalline RE-Fe-B, AlNiCo, and Cr-Fe-Co magnets of the domain microparticle type;

finally, various permanent magnet materials are removed from their initial state after thermal demagnetization.

The recommended magnetic field strengths for achieving full saturation are summarized in Table 1.

1 Scope

This document describes the magnetization behavior of permanent magnet materials and provides recommendations for the saturation magnetization magnetic field strength of different magnets.

This document applies to the saturation magnetization of permanent magnet materials such as rare earth iron boron, samarium cobalt, permanent magnet ferrite, and AlNiCo.

2 Normative references

This document has no normative references.

3 Terms and Definitions

This document does not contain any terms or definitions that need to be defined.

4 Effective magnetization field strength

When magnetization is performed using a DC magnetic field, the effective magnetization field strength is equal to the internal magnetic field strength of the magnet; when magnetization is performed using a pulsed magnetic field, the effective magnetization field strength is equal to... The strength of the internal magnetic field of a magnet under a pulsed magnetic field with a pulse width of 5ms to 10ms.

For the magnetization process of a permanent magnet, the internal magnetic field strength H_{int} is a crucial parameter. The internal magnetic field strength is determined by the external... The applied magnetic field strength H_{appl} and the self-degrading magnetic field strength H_{demag} of the magnet or magnet assembly are determined. The self-degrading magnetic field strength depends on the magnet or magnet assembly.

The dimensions of the load line and the magnetic polarization intensity of the magnet material are given in formula (1).

The internal field is the applied field minus the self-demagnetizing field, which depends on the demagnetizing factor N and the magnetic polarization J .

Currently, most permanent magnet materials are magnetized using pulsed magnetic fields, which are obtained by discharging a capacitor bank into a copper coil. (Pulse width)

The pulse width needs to be large enough to overcome the eddy currents generated on the magnet surface, especially for large magnets; typically, the pulse width is in the range of 5ms to 10ms.

Only a sufficient range of forces is needed for the magnetic field to penetrate the magnet. The penetration depth λ depends on the material's resistance ρ , permeability μ , and the frequency f of the pulsed magnetic field.

Magnets should ideally be magnetized after assembly, as unmagnetized magnets are easier to handle and prevent contamination by ferromagnetic particles. Furthermore, it is also possible to... To prevent the magnet edges from cracking due to mutual attraction between magnet components.

5 Initial magnetization state

For nucleated ferrites, SmCo₅, and REFeB magnets, the initial magnetization state is usually the state after thermal demagnetization, i.e., the state after sintering.