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Magnetizing behaviour of permanent magnets

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MAGNETIZING BEHAVIOUR OF PERMANENT MAGNETS

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IEC 62517, which is a technical report, has been prepared by IEC technical committee 68: Magnetic alloys and steels.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
68/377/DTR	68/384/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

The full performance of a permanent magnet can only be obtained if it is magnetized properly to saturation. In IEC 60404-5 a definition of the saturation of a permanent magnet is given. Accordingly, a magnet is defined as saturated at a magnetizing field strength H_1 if a 50 % higher field strength leads to an increase of $(BH)_{max}$ or H_{cB} of less than 1 %. However, such a definition cannot explain the substantial differences in the magnetizing behaviour of modern permanent magnets which is mainly determined by their coercivity mechanisms. Unfortunately the variety of magnetizing behaviours cannot be accommodated by a simple recommendation such as “magnetize with magnetizing field strengths of three to five times the coercivity H_{cJ}”. In particular for RE permanent magnets with high coercivity H_{cJ} this simplification would lead to unacceptable overestimations of the required magnetizing field strengths.

MAGNETIZING BEHAVIOUR OF PERMANENT MAGNETS

1 Scope

It is within the scope of this technical report to describe the magnetizing behaviour of permanent magnets in detail. Firstly, in Clause 3 the relationship between the applied magnetic field strength and the effectively acting internal field strength is reviewed. In Clause 4 the initial state prior to magnetization is discussed. Then, in the main Clause 5, the magnetizing behaviour of all common types of permanent magnets is outlined. The clause is subdivided according to the dominant coercivity mechanisms, namely the nucleation type for sintered Ferrites, RE-Fe-B and $SmCo_5$ magnets, the pinning type for carbon steel and Sm_2Co_{17} [1] magnets and the single domain type for nano-crystalline RE-Fe-B, Alnico and Cr-Fe-Co magnets. Finally, the recommended magnetizing field strengths for modern permanent magnets are compiled in a comprehensive table.

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[1] The composition Sm_2Co_{17} is used as the generic name for a series of binary and multiphase alloys with transition elements such as Fe, Cu and Zr replacing Co, see also IEC 60404-8-1; 2nd edition 2001.