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Sulfur corrosion test method of copper winding in electric field for power equipment

Méthode d'essai de corrosion par le soufre des enroulements en cuivre dans un champ électrique pour les équipements électriques

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Foreword

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This document was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Many factors affect the sulfur corrosion of copper windings in power equipment in the power industry. These include:

— temperature;

— corrosive sulfide concentration in oil;

— acid products derived from oil-paper insulation aging;

— moisture;

— the type of electric field (AC or DC electric field);

— electric field strength;

— the contact state between the copper winding and the insulating paper;

— the quality of the copper winding.

These have a significant influence on the occurrence of sulfur corrosion and the generation of corrosion products. The current assessment methods of sulfur corrosion of copper windings do not sufficiently consider these factors. Existing standards (e.g. ASTM D 1275A, ASTM D 1275B, IEC 62535, GB/T 25961) test specifications or methods for testing whether the quality of insulating oil meets the requirements.

As for the corrosion of copper, the existing standards are test methods for the corrosion of copper metal in the atmospheric environment, petroleum products, etc. Standards such as GB/T 38265.15, ASTM D 130 and ISO 6251 specify special testing or assessment methods for lubricants, oil and copper parts in atmospheric environments (e.g. pipelines, tower parts and other structures), which does not fully apply to power equipment.

Therefore, with reference to the existing standards for corrosive sulfur detection in insulating oil, this document proposes a sulfur corrosion test method for copper winding in electric field for power equipment. The method includes pre-treatment, model construction, the corrosion test method and corrosion level judgments for copper windings.

This document contributes to controlling the quality of copper windings in electric power equipment, reducing the failure of electric power equipment due to sulfur corrosion and prolonging the service life of power equipment, which has great significance in improving the safe operation of power grids.

This document considers the effects of actual working conditions (e.g. electric field, the contact state between the copper winding and the insulating paper) and the quality of the copper winding on the sulfur corrosion of copper windings in power equipment. It considers the influencing factors listed in this Introduction to avoid the assessment deviation of sulfur corrosion resistance of copper windings in the existing standards.

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Sulfur corrosion test method of copper winding in electric field for power equipment

1 Scope

This document specifies the assessment of copper winding sulfur corrosion in power equipment. It is applicable to the sulfur corrosion resistance testing of copper windings in newly installed and in-service power equipment.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
copper content
mass fraction of substances determined by the procedure described in this document

Note 1 to entry: The copper content is expressed as milligrams per kilogram (mg/kg).

3.2
corrosive sulfur
elemental sulfur or thermally unstable sulfides in insulating oils for electrical equipment, which is corrosive to metals such as copper and silver

3.3
sulfur corrosion resistance
ability to resist corrosive sulfur corrosion under certain conditions

4 General regulation

First, the test copper winding and insulating paper are constructed as a pig-tail model (see Figure 1). Then, the pig-tail specimen is immersed in insulating oil that contains corrosive sulfides for the corrosion test at a specific temperature and a specific electric field strength. Finally, the sulfur corrosion resistance of the copper windings is qualitatively assessed based on the macroscopic morphology of the copper windings and quantitatively assessed based on the copper elemental content in the insulating oil.

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