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Guidance on the measurement of wettability of insulator surfaces

Mesure de l'hydrophobicité de la surface des isolateurs

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GUIDANCE ON THE MEASUREMENT OF WETTABILITY OF INSULATOR SURFACES

FOREWORD

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62073, which is a technical specification, has been prepared by IEC technical committee 36: Insulators.

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

Enquiry draft	Report on voting
36/185/DTS	36/197A/RVC

Full information on the voting for the approval of this technical specification 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 2006. At this date, the publication will be

- transformed into an International standard;
- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INTRODUCTION

The wetting properties of a surface by water are commonly described by the terms hydrophobic (or hydrophobicity) and hydrophilic (or hydrophilicity). A hydrophobic surface is water-repellent, while a surface that is easily wetted by water is hydrophilic.

The wetting phenomenon of a surface is complex and many different parameters can influence its apparent wettability. Some important parameters include: type of insulator material, surface roughness, heterogeneities of the surface, chemical composition (e.g. due to ageing) and presence of pollution. For some of the insulator materials in common use, the wetting properties can change over time, due to the influence of the ambient conditions. This change can be either reversible or irreversible. Thus, the result of the measurement of the wettability may be influenced by the ambient conditions and the HV corona or dry-band arcing to which the insulator has been previously exposed. This dynamic wetting behaviour is more or less specific to different insulator materials.

The dynamic wetting behaviour exhibited by insulator materials is due to their chemical composition. Different processes such as oxidation, hydrolysis, migration of low molecular weight compounds, formation of complex compounds between e.g. siloxanes and water, rotation of flexible polymer chains, inter- and intra-molecular rearrangements, microbial growth, deposition of contaminants, adhesion and encapsulation of contaminant particles, may take place at different rates, depending on material and ambient conditions. Thus, wettability along and around an insulator can vary, due to differences in the exposure to solar radiation, rain, corona discharges, deposited pollution, etc. Therefore, wettability measurement of insulators should be performed on several separate areas of the insulator.

Measurement of the wettability of a surface is readily performed in the laboratory on well defined, homogeneous, smooth and planar surfaces of prepared specimens. In the case of insulators, for which non-destructive measurements are usually required (and where cut-out of material samples is usually not desired), these conditions do not exist and measurement with high precision is a difficult task. This is especially true when the measurement has to be performed on an insulator installed in an overhead line, substation or even in a high voltage test set-up in the laboratory.

GUIDANCE ON THE MEASUREMENT OF WETTABILITY OF INSULATOR SURFACES

1 Scope and object

The methods described in this technical specification can be used for the measurement of the wettability of the shed and housing material of composite insulators for overhead lines, substations and equipment or ceramic insulators covered or not covered by a coating. The obtained value represents the wettability at the time of the measurement.

The object of this standard is to describe three methods that can be used to determine the wettability of insulators. The determination of the ability of water to wet the surface of insulators may be useful to evaluate the condition of the surface of insulators in service, or as part of the insulator testing in the laboratory.

2 Terms and definitions

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

2.1
wettability
ability of a surface to be wetted by a liquid (e.g. water)

2.2
hydrophobicity and hydrophilicity

2.2.1
hydrophobicity
low level of wettability by water of a surface. A hydrophobic surface has a low surface tension and thus is water-repellent

2.2.2
hydrophilicity
high level of wettability by water of a surface. A hydrophilic surface has a high surface tension and thus is wetted by water (in the form of a film)