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The influence of semiconductive screen materials on electrical performance

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Sommaire

L'arborescence électrique représente le principle mode de défaillance des isolants HT et THT. D'une manière générale, l'arborescence électrique provient des augmentations locales des contraintes. Ces augmentations de contraintes sont considérées comme facteur très important dans le vieillissement électrique. Des études en laboratoire portant sur le début de l'arborescence ont été effectuées avec une aiguille semiconductrice enfoncée dans une matrice en PR. Ce montage crée une géométrie d'électrodes pointe-plan qui modélise la situation pratique beaucoup mieux que les études classiques faisant appel à une aiguille métallique. L'analyse identifie les facteurs importants qui influent sur la tension à l'origine de l'arborescence en présence aussi bien d'une rampe à courant alternatif que d'une contrainte constante.

Abstract

Electrical treeing is the major failure mode in HV & EHV insulations. Electrical treeing, in general, originates from local stress enhancements. These stress enhancements are considered to be a very important factor in electrical ageing. Laboratory studies of the tree initiation have been performed with a semiconductive needle embedded in the XLPE matrix. This arrangement creates a point - plane electrode geometry which more closely models the practical situation than traditional metal needle studies. The analysis identifies the important factors that influence the tree initiation voltage under both AC ramp and constant stress conditions.

Introduction

The insulation wall thicknesses of HV and EHV XLPE cables are being progressively reduced and the subsequent cable design stresses increased. Therefore it is important that the most appropriate material combination (semicon and XLPE insulation) is selected. This paper will show that the correct choice of semicon and XLPE insulation materials provide enhanced resistance to electrical tree inception. A greater resistance to electrical treeing will permit a cable to operate at higher design stresses.

Electrical treeing is the development of permanent dry channels in an insulation. These become carbonised through partial discharge activity. The carbonisation advances the voltage front through the material causing the local electric field to increase. Insulation failure then becomes more likely at the elevated electrical fields. This is the major failure mode in HV and EHV insulations. Therefore there is a need to experimentally replicate the treeing process on a laboratory scale. This requirement can be satisfied by producing high electrical stress specimens which consist of a semicon needle with an earth plane.

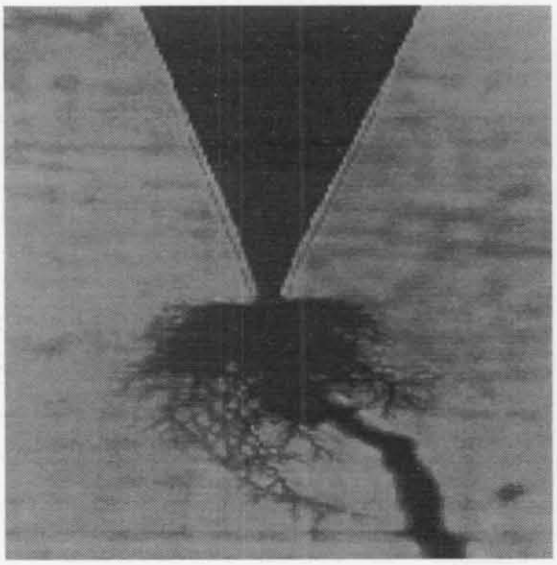

Figure 1 Typical electrical tree and failure channnel