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B.10.3 Diagnostic de l'isolation des câbles polyéthylène par suivi de l'électroluminescence

MARY D., LAURENT C., MAYOUX C., Université P. Sabatier, Toulouse, France
BERDALA J., Câbles Pirelli, Paron, France
CLAVREUL R., EDF/DER, Moret/Loing, France

Résumé

Les auteurs ont cherché à étudier les informations que pouvaient apporter les mesures d'électroluminescence dans le domaine du vieillissement des isolants synthétiques des câbles de transport d'énergie. Les premiers résultats qui sont présentés ici et qui ont été obtenus sur du polyéthylène réticulé (PR) ont permis de différencier deux populations dont la première concernait le matériau initial tandis que la seconde était le polymère vieilli sous un champ électrique élevé pendant quelques milliers d'heures. Cette technique a permis de détecter une évolution du matériau liée au vieillissement électrique.

B.10.3 Diagnosing power cable polyethylene insulation by electroluminescence monitoring

MARY D., LAURENT C., MAYOUX C., Université P. Sabatier, Toulouse, France
BERDALA J., Câbles Pirelli, Paron, France
CLAVREUL R., EDF/DER, Moret/Loing, France

Abstract

The authors have tried to study the informations provided by electroluminescence measurements and their impact in the domain of diagnosis polymer ageing. The first results presented here were obtained on cross-linked polyethylene (XLPE). They seem to show that the electroluminescence thresholds are related to the aged condition of specimens. The sensitivity of detection of this technique reveals its usefulness as a tool to analyze the ageing conditions of a cable insulating material.

Introduction

Polymers used as electrical insulating materials, e.g. in high voltage cable, are submitted to working stresses which are responsible of an irreversible evolution of their physico-chemical properties against time. For an insulating material the electrical breakdown is the ultimate stage of this evolution. It is therefore essential to be able to evaluate the degree of ageing of the insulation.
In the domain of high voltage cross-linked polyethylene insulated cables and in dry conditions, we can consider that voltage and temperature are the main stresses. The modifications of the insulation properties under the effects of working stresses are most often very difficult to analyze. On the one hand, ageing can be localised and on the other hand, it is a cumulative process through low level perturbation of the material structure. However, this low level degradation mechanism could play an important role as, for example, an activator of deterioration process taking place in the vicinity of local defects.
In order to be able to evaluate material ageing, comparative measurements are generally undertaken. The analytical techniques ordinary used are physico-chemical analysis (infra-red spectroscopy, differential scanning calorimetry, etc.) or dielectric spectroscopy (loss tangent, transient and conduction current, etc.). Apart from severe ageing conditions that lead to heavily degraded materials, it is often difficult to conclude since measurements scatter over a wide range on the same sample [1] [2]. Moreover, the significant parameter which would be related to the ageing degree of the materials is not known. For example, one can measure a difference of the oxidation degree of reference and aged samples, but oxidation by itself can have no influence at all on the breakdown strength of the two different specimens. We can think that a technique specifically probing the aged area can be more efficient. Electroluminescence could be