A.7.6. Mesure des distributions des charges d'espace sous tension alternative 50 Hz

BERT C., HENNION C., HLP, Paris, France
LEWINER J., ALQUIÉ C., ESCPI, Paris, France
HAMPTON N., BICC Cables, Erith, Royaume Uni
FREESTONE J., BICC Cables, Clwyd, Royaume Uni
VERNE S., BICC plc, Herts, Royaume Uni

Résumé

Une méthode de détermination des distributions de charge d'espace dans des isolants soumis à des contraintes alternatives à 50 ou 60 Hz est présentée. Un instrument a été développé qui utilise la propagation d'une onde de pression dans l'échantillon. Des résultats préliminaires sont rapportés.

A.7.6. Measurement of space charge distributions under 50 Hz AC stress

BERT C., HENNION C., HLP, Paris, France
LEWINER J., ALQUIÉ C., ESCPI, Paris, France
HAMPTON N., BICC Cables, Erith, UK
FREESTONE J., BICC Cables, Clwyd, UK
VERNE S., BICC plc, Herts, UK

Abstract

In this paper we present a method for the determination of space charge distributions in dielectric materials submitted to an AC stress at 50 Hz or 60 Hz. An instrument has been developed which uses the propagation of a pressure wave in the sample. Preliminary data are reported.

Introduction

During the last few years, many efforts have been devoted to the measurement of space charge distributions in DC stressed insulators [1]. Non destructive methods have been developed and results are now being reported on various materials and structures [2-3]. These methods are based either on the diffusion of heat in the sample or on the propagation of a pressure wave.

Three years ago it was suggested [4] to apply the same principle to AC stressed structures. This was possible since, in the case of propagation techniques, the time of propagation through the sample, that is to say the duration of one measurement is typically of the order of a microsecond. This time is very short as compared to the period of one cycle at 50 Hz or 60 Hz. Under these conditions, the measured variables can be considered as constant in time during a measurement : there should be no significant change in applied stress or electrical response of the material under test during this time.

In this paper we will describe an experimental set up which is based on the assumption that space charge effects are similar at a given phase angle for different cycles. Thus, measurements are made with a repetition rate of about 1 Hz but at phases of the AC wave which are well controlled and successively increased from one measurement to the next one.

We present preliminary results which were obtained on cross linked polyethylene based structures such as plaques or cables and apply statistical methods for the analysis of the data .

These results show that space charge can appear even at the short times involved in AC stressed systems. In some cases the magnitude of the space charges is sufficient to modify the AC field distribution.

Experimental

Principle It is well known that space charge distributions in insulators can be measured in a non destructive way by propagating through the sample a pressure wave [5-7]. If this wave has a simple shape such as a step or a pulse then the electric signal produced across the electrodes during the propagation of the wave has a simple relationship with the internal electrical parameters. The wave front of a step shaped wave directly measures the electric field distribution whereas in the case of a short duration pulse it gives the charge distribution. Therefore during the succession of events : penetration of the pulse in the sample, propagation and then exit at the other electrode, the observed signal is first representative of the interfacial field close to the input electrode, then of the space charge encountered by the wave front during its propagation and finally of the electric field near the exit electrode.