## B.5.3. Nouveaux matériaux isolants pour câbles HT

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**Résumé** :

Le comportement électrique des matériaux polymériques est fortement dépendant de leurs structures et morphologies.

En effet, on peut constater à travers la littérature que la modification du polyéthylène (PE) par adjonction de quantité appropriée de charges minérales, ou de groupements fonctionnels (ioniques, organiques polaires ou non polaires) modifie ses propriétés de rétention de charges et sa tenue au claquage.

La préparation de nouveaux matériaux pour isolation des câbles HT et THT a été entreprise par adjonction dans le PE de polymères polaires et non polaires. Après évaluation des propriétés structurales, mécaniques et électriques, un câble modèle a été fabriqué. Sa tenue diélectrique a été évaluée notamment en fonction de la pression.

Les auteurs présentent dans cette communication les caractéristiques de l'un de ces nouveaux matériaux comparativement au PE. Les résultats obtenus laissent envisager des perspectives intéressantes quant à l'application des PE modifiés.

**Summary** :

The electrical behaviour of polymers depends strongly on their structure and morphology.

In fact, it can be seen through the litterature that addition into polyethylene (PE) of an appropriate concentration of a given filler, or ionic, polar or unpolar groups containing polymers modifies the PE charges trapping ability and its breakdown strength.

The materials we developped are composed of PE and a polar or unpolar polymer. Their structure, mechanical and electrical behaviour have been evaluated, a model cable has been produced and tested notably under growing pressure.

In this paper, some of the characteristics of one of the developped materials are compared to the PE ones . The obtained results allow to expect an interesting prospect for the modified polyethylene materials.

### 1/ INTRODUCTION

The improvement of HV and VHV cables necessitates the improvement of the dielectric behaviour of the insulating system.
Since, on one hand, space charge seems to be at the origin of ageing and breakdown of insulators (1,2), and the other hand charges trapping and relaxation depend on the insulator morphology (3), modification of the insulating materials structure (more generally their intrinsic characteristics) may modify their response to electrical and/or thermal stresses.

The response of liquid or solid dielectric to space charge (trapping, distribution, release...) can be modified by adding additives into the dielectric. Investigation in that field have been already published (4-7).

The aim of the work we undertook is to develop more reliable materials taking into account data of fundamental studies concerning the relationship between polymers morphology and their dielectric behaviour.

This paper describes briefly some of the results obtained at each step of development of the modified PE materials.

### 2/ EXPERIMENTAL

The polymer alloys morphology has been characterized using a scanning electron microscope, Jeol JSM6400F.

Impulse breakdown strength measurements :

Impulse tests with and without dc polarization (30 kV, 1 hour, positive polarity) have been performed on at least 12 samples (Figure 1).

The impulse withstand values were obtained by the following procedure :

1.2 /50 µs standardized impulses
Start at 50 kV
Steps of 10 kV
One impulse at each step
Positive polarity
Temperature : 70°C

A cross section of the test sample is shown on Figure 1.

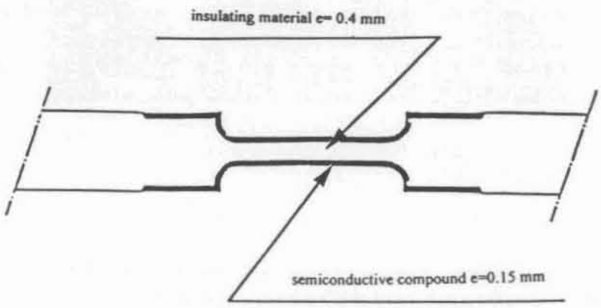


Figure 1 : Cross-section of a sample used for the impulse breakdown strength measurement

DC breakdown strength measurements :

The experimental apparatus (8) consists of a high pressure bomb (9500 $cm^3$) into which was placed a measuring cell, a pressure generator, and a breakdown detector system. The pressure in the bomb is obtained by a diaphragm compressor using gaseous nitrogen as a transmitting fluid. A maximum dc voltage of 100 kV can be applied successively to eight samples, via high-voltage relays placed in the measuring cell.