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Evaluation of a new EPDM insulation compound for HV cable accessories

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Résumé

Les paramêtres qui affectent les performances de l'isolation des accessoires préfabriqués de câble HT ont été étudiés. L'influence de la base polymérique EPDM a été considéré de même que celle renforcements et des additifs. Les résultats montrent qu'une plus grande cristallinité de l'EPDM augmente la rigidité dielectrique. De plus la réticulation a été identifiée comme un paramêtre important. Les pertes dielectriques diminuent par l'utilisation d'un polymerisant peroxide par rapport au souffre rendant de plus le dégazage moins nécessaire.

Abstract

Factors which influence the performance of the insulation in prefabricated HV cable accessories have been studied. The influence of the EPDM base polymer has been studied as well as fillers and additives. The results show that higher EPDM crystallinity increases the dielectric breakdown strength. Also the crosslinking system has been identified as an important parameter. The dielectric losses are decreased by using peroxide crosslinking instead of sulphur crosslinking making degassing less necessary.

Introduction

HV prefabricated cable accessories require materials with good mechanical and electrical properties. Cable joints and terminations for the highest voltages are very crucial parts since their electrical behaviour is very critical for the overall performance. Also the mechanical properties should allow easy installation of e.g. a cable joint.

EPDM resins are well-known to have good electrical properties but the addition of fillers and other additives influences the electrical insulating properties [1]. In this work an investigation is presented with the purpose to improve the electrical properties, such as the dielectric losses and the breakdown strength, while maintaining the processability and the mechanical properties of the EPDM compound.

Several factors have been studied; the EPDM base resin crystallinity, the filler composition and the crosslinking system.

Compounds

All new compounds were based on different EPDM polymers from DuPont (Nordel® range) with different molecular weight, crystallinity (w_c) and ethylene /propylene/diene ratio (Table 1).

The crystallinity change due to crosslinking and compounding is shown in Table 2. After crosslinking and compounding with filler the EPDM crystallinity reaches a rather low value of about 4%. Naturally, blending with the amorphous 2522 resin decreases the crystallinity further.

Table 1. Properties of NORDEL® (DuPont)

Polymer	MW	MWD	w_c	E/P/D wt%
1040	210000	broad	low	54/42/4
1470	290000	broad	low	55/39/6
2522	170000	broad	low	50/44/6
2722	180000	broad	high	72/22/6

Data taken from DuPont data sheet.

Table 2. Crystallinities (w_c) and melting peak temperature by DSC.

Polymer	w_c	T_m [°C]
Nordel 2722 crosslinked	0.115	43
Nordel 2722/2522 75/25	0.095	43
2722/2522 75/25 crosslinked	0.06	42
Nordel 1470	amorphous	
Nordel 1040	amorphous	
Nordel 2522	amorphous	
Vistalon 2504	amorphous	
Compound No. 10	0.04	42

Data recorded by Perkin Elmer DSC-7.