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# Use of numerical simulation to develop a new semiconductive layer for HV cables

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**Résumé :**
L'article compare les résultats de simulations numériques d'extrusion obtenus avec une nouvelle formule semi-conductrice par rapport à ceux de la formule de référence.
Dans un second temps, l'écoulement de la nouvelle formule dans la tête d'extrusion est modélisé.
Les résultats montrent que l'utilisation d'une bague est nécessaire pour répartir uniformément la matière sur le câble.
Enfin, un essai sur ligne de production permet de valider ces observations.
Les auteurs concluent que la simulation numérique d'extrusion est donc un outil permettant d'accroître les connaissances en rhéologie et de diminuer le nombres d'essais sur lignes de fabrication.

**Mots clés** : simulation numérique, écran semi-conducteur, rhéologie, tête d'extrusion

**Abstract :**
This paper deals with simulation tools used when introducing a new material to observe the flow in the extruder, and compare it with the reference.
Similarly, the crosshead is modelled to see the behavior of the material.
Simulation results show that rings are to be used to distribute in an uniform way the material on the cable.
Finally a trial on the extrusion line was carried out. The results matched those predicted by the simulation program.
Therefore it can be concluded that numerical simulation of extrusion could be a very efficient tool to improve our knowledges in rheology and to reduce the number of trials required for introducing a new material.

**Keywords :** numerical simulation, semiconducting screen, rheology, extrusion head

## 1. Introduction

When developping a new material for semiconducting screen of a MV or HV cable, two majors aspects are to be considered:

- Compliance with specification
- Good processability of the material

If laboratory tests (electrical, physical...) can be carried out to select formulation complying with the specification, trials on the production lines are necessary to obtain informations about the processability.
So, using a simulation of extrusion software can be interesting to reduce both the number of trials and the cost of the development.
This paper shows that rheological results allowed a better understanding of the flow of a semi-conductive material in the extrusion tools.
In a first step, tests were carried out with the RPA (Rubber Process Analyser) and a laboratory extruder to obtain viscosity curves of the two products (the new one and the reference material).

Then these rheological and thermal data , such as conductivity or calorific capacity, are entered in the software.
The first simulation consists in validating the software. For this, experimental results are compared with simulation ones.
Then numerical simulation is used to study the flow of the new material in the extruder, and compare it with the reference.
The main characteristics such as solid bed ratio, pressure or temperature along the screw are described in the paper.

In a second step, the crosshead has been modelled to see the behavior of the material and to help in the design of the rings used to obtain an uniform laying of the material on the cable.