IMPROVING SURFACE SMOOTHNESS OF SEMI CONDUCTIVE SHIELDS BY BLENDING ETHYLENE COPOLYMERS

Laurent **GERVAT**, Sébastien **QUINEBECHE**, ARKEMA, (France),
laurent.gervat@arkema.com, sebastien.quinebeche@arkema.

Oliver **HISSMANN**, OCS, (Germany), hissmann@ocsgmbh.com

ABSTRACT

Particular care must be given to conductor-shields smoothness because any sharp protrusion dramatically enhances in its vicinity the electrical stress, one of the most common causes for electrical failure. It was found that a particular blend of ethylene-acrylate copolymers improves the smoothness of semi conductive shield surfaces. The analysis was done with a Nip Detection System that consists of an extruded tape polished in a defined gap and then scanned with a laser beam to determine with micrometer accuracy the height and the base diameter of every protrusion.

KEYWORDS

Semiconductor shield; Smoothness; Electrical stress enhancement; Protrusion; Shape factor; Ethylene copolymer; On-line analysis; Quality control.

INTRODUCTION

The progressive replacement of paper-insulated cables by XLPE has been achieved thanks to progress in the reliability and longevity of their three constitutive layers. Appropriate design is key, together with a reliable production of compounds, as guaranteed by dedicated Close-Loop online measurements during their manufacture.

Among the three layers, this paper will focus on the conductor-shields: It consists in a cross linked semi conductive composition of carbon black, carefully dispersed into a suitable polymeric matrix - usually a copolymer of acrylate and ethylene. Particular care must be given to the shield because any impurity near the surface may give birth to water trees and any conductive protrusion dramatically enhances in its vicinity the electrical stress, which is one of the most important causes for electrical failure.

EXPERIMENTAL

Semiconductive compounds

Compounds of the following composition were prepared with a Buss Co-kneader PR46:

- Carbon black : 38 % (unless otherwise specified)
- Ethylene Copolymer : 60.2 %
- Antioxidant (TMQ): 0.8 %

Strips were then produced directly with the single screw extruder or the nips detector.

Surface analysis

The analysis was done with the new OCS Nip Detection System dedicated to conductor shields. It consists of an extruded tape polished in a defined gap and then scanned on a high precision stabilisation roller with a laser beam (Figure 1). A CCD-line scan determines with micrometer accuracy, the dimension (height and diameter) of every protrusion of the polished film and takes a picture of it (Figure 2). The defects are then labelled and sorted out in a separate bin for further laboratory analysis whenever needed. For each sample, the measurements were performed on the analysis of a half square meter of film.

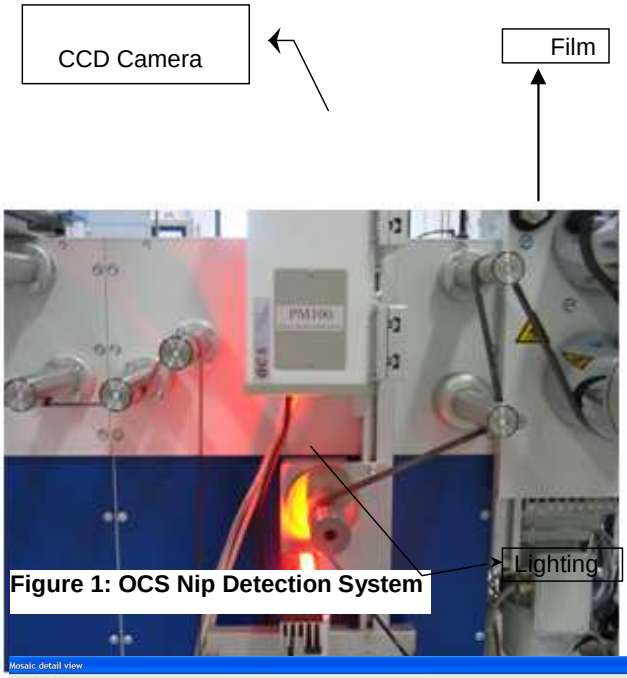

Figure 1: OCS Nip Detection System

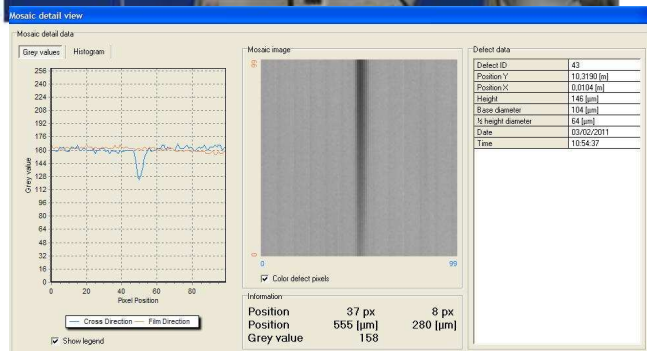

Figure 2: Detail of a protrusion