

Investigation of electrical and morphological properties of 10kV XLPE cable insulation specimens

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Nowadays cable and wire manufacturers and consumers are interested in the development of new test methods and search of additional criteria for product quality assessment.

The paper presents the investigation results for the specimens of commercially produced 10kV XLPE cables fabricated (using manufacturing technology) at different plants, under different production conditions but on similar equipment with the use of the same materials.

The investigation involved the analyses of the following: the morphology peculiarities (specimen structure) by optical and thermal methods, the insulation system defect rate (the number of thermally modified polyethylene particle inclusions in the insulation and semiconducting screen protrusions), the insulation resistance to electrical tree origination and growth.

The electrical tests were conducted on specimens with inserted calibrated defects. The test setup allowed monitoring under high voltage and with high optical resolution of the process of electrical tree origination and development.

The investigation results indicate that the minimum defect rate of the insulation system was observed in the specimens fabricated at minimal/moderate extrusion speeds, and the maximum polyethylene insulation resistance to electrical tree origination and development was observed in the specimens with a lower melting temperature (lower degree of crystallinity).

The investigations demonstrated that lower values of the crystallinity degree refer to the specimens with smaller embryonic spherulites.

Key words

Electrical insulation; Cross-linked polyethylene (XLPE); Thermal analysis; Optical microscopy; Electrical tree