
B.6.1.

Survey of space charge evolution in high voltage cables submitted to AC voltage in the frame of Artemis project

Petru Notingher jr., Alain Tourelle, Serge Agnel, Nicolas Didon, Jérôme Castellon¹, Stéphane Malrieu¹

Laboratoire d'Electrotechnique de Montpellier (LEM), Université Montpellier II, place Eugène Bataillon, 34095 Montpellier cedex 5, France

¹ Advanced Metrology for Electrical Engineering (Am2e), Montpellier, France

The comprehension of the fundamental mechanisms involved in the decrease with time of the dielectric properties of cross-linked polyethylene cable insulation, and thus the identification of the parameters related to its electrical and thermal ageing is of considerable interest for predicting the long-term behavior of new and installed high voltage cables. By non destructive charge measurement methods set up in recent years, links have been made between the time-to-breakdown and the electric charge accumulated within insulating materials under dc and ac conditions (space charge). The aim of the present work, performed in the frame of the ARTEMIS project (concerned with the identification of ageing markers of high voltage cables), was to investigate space charge evolution in cable insulation and to correlate it to ac ageing.

An experimental set up based on the the thermal step method (TSM) has been employed to survey the evolution of the charge in 90 kV power cables during ac ageing. The principle used for the experimental bench (namely the "outer cooling technique" OCT) consists of applying, by a cold liquid, a thermal step on the outer semicon of the cable and to measure a capacitive current response which is a function of the electric charge contained in the cable insulation. The measurements have been performed on cable pieces taken periodically from cable loops subjected, in industrial facilities, to ac fields between 12 and 30 kV/mm rms at room temperature and at 90°C during 14 months. The evolution of the charge trapped in the cables was found to be significantly dependent on the ageing conditions. A trend of the amount of trapped charge to increase with the ageing time, field and temperature has been observed. The obtained results give further evidence that space charge accumulation can be regarded as an indicator of the evolution of the electrical state of the cable insulation.