

Study of the thermal ageing of the XLPE for HVDC applications

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Electricity networks of the future are moving towards supergrid networks. These networks will use HVDC voltage to supply center of consumption from sources that are far from them or to connect different countries together. The objective is to ensure network stability and security, especially with contribution renewable energies like large off-shore wind farms and solar plants.

In some areas the HVDC network is mainly based on submarine and land. The reliability of the cables depends strongly of the quality of the synthetic insulation based on cross-linked-polyethylene (XLPE).

The objective of this paper is to propose characterization methods of the XLPE insulation before and after thermal ageing. In order to identify some ageing makers, the insulating material is studied by physical-chemical techniques.

Among the available techniques, Differential Scanning Calorimetry (DSC), the Fourier Transform Infra-Red spectroscopy (FTIR) and the thermo gravimetric analysis (TGA) can already give good markers of the evolution of the vulcanized polymer morphology. Consistent evolutions of melting temperature, cristallinity and presence of carbonyle, CH₂ and CH₃ groups gives trends of the physic-chemical ageing and potential impacts on properties of XLPE.

Keywords: XLPE, DSC, TGA, FTIR, XRD, thermal ageing