Development of 320kV subsea/underground HVDC extruded cable system

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ABSTRACT

HVDC extruded cables used original insulation material and their accessories have been developed. As for land cable system development, DC320kV prequalification test and type test in accordance with CIGRE TB-496 have been completed. On the other hand, for sub-marine cable system, DC320kV type test has been completed. Prequalification test is in progress and will be completed in middle 2015.

KEYWORDS

HVDC, DC-XLPE, pre-molded accessory, space charge

1. INTRODUCTION

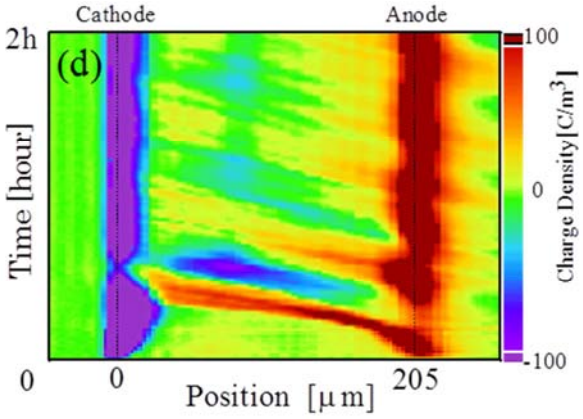
In recent years, high voltage direct current (HVDC) systems have been more frequently applied to long distance transmission use; for example, transmission to islands and export from offshore wind farms, due to their advantage in transmission efficiency. A lot of HVDC systems used for not only subsea but also underground transmission have been reported. For HVDC system application, the oil filled or mass impregnated paper insulated cable were mainstream up to 500kV system. Nowadays, for environment friendliness and maintenance-free use, application of the extruded HVDC cable has increased up to 320kV class.

The original insulation material has been developed. It is named as “SXL-A”. “SXL-A” has good electrical performance to be needed for HVDC insulation. Pre-molded accessories with ethylene-propylene rubber (EPDM) for HVDC system have been also developed. As for land cable system development, DC320kV prequalification test and type test were carried out with a combination DC XLPE cable and pre-molded accessories, and were successfully completed without any problem. As for sub-marine cable system including a factory joint, DC320kV type test has been completed. Prequalification test is in progress and will be completed in middle 2015. This paper introduces VISCAS’ high quality HVDC extruded cable system.

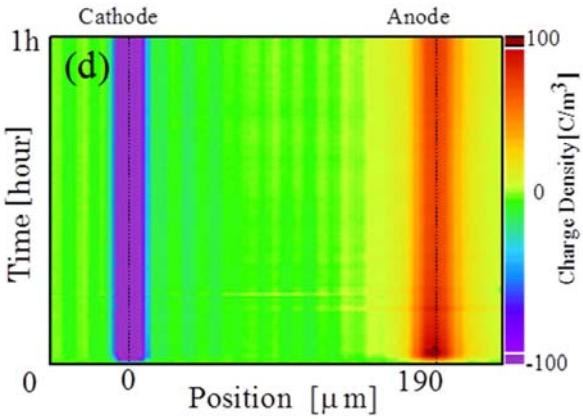
2. BASIC DC PROPERTIES OF INSULATION MATERIALS

2.1 Cable

Cross-linked polyethylene (XLPE) with the conductive inorganic filler is used for the HVDC cable [1]. The material is called “SXL-A”. “SXL-A” has excellent DC electrical performance. Figure 1 shows the space charge measurement resuls to evaluate the effect of the filler. The measurements were carried out by means of the PEA (Pulsed Electro-Acoustic) method. Test samples were flat sheets in approx 0.2mm insulation thickness. In the case normal XLPE material which dosen’t have special filler, the generation near the anode, movement to the counter side and disappearance near the cathode of the positive packet-like charge are repetitively observed. On the other hand, such space charge formation does not appear in the case of SXL-A which have special filler. So, the filler is supposed to play a role as a trapping site in the XLPE insulation and can drastically improve DC field performance [2].



(a) Without the filler



(b) With the filler content of 0.1wt%

Figure 1. Space charge measurement results in flat sheet at 200kV/mm