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Mon-Af-Po1.23-03 [112]: Assessment of Dielectric Breakdown Characteristics of Nomex Paper under High Frequency Overvoltages for Superconducting Power Transformer Application

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Insulation materials have different electrical characteristics according to temperature and voltage frequency. These characteristics are very significant factors for the insulation design of high voltage power apparatus. Since there are not always consistent overvoltages, it is necessary to ensure the dielectric strength against various overvoltages. In particular, high voltage power transformers can be exposed to overvoltages of very high frequency components caused by external switching operations and lightning strokes, which can lead to dielectric breakdown. In addition, in order to develop a superconducting power transformer, the insulation characteristics of material for these overvoltages should be reliable in a cryogenic environment. However, researches on non-standard impulse overvoltages are limited. In this paper, lightning and switching impulse dielectric breakdown experiments were performed to analyze the effect of overvoltage frequency on dielectric strength. In order to make different oscillation frequencies of the impulse overvoltages, the front time was set differently by adjusting resistors of impulse generator. Nomex paper used as conductor insulation for power transformer were tested in liquid nitrogen using two electrode types. Uniform electric field electrodes are composed of two same cylinder shaped materials. Turn to turn electrodes were composed of varying the number of Nomex paper layers. The difference of dielectric breakdown characteristics between lightning and switching impulse was analyzed by varying the front time and oscillation frequency. From the experiments, we have confirmed that the insulation properties of dielectric material are different depending on the type of front time, oscillation frequency and overvoltage source.

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