# 발전소 6.9kV급 XLPE 케이블 절연재의 온도에 따른 절연파괴 특성분석

## Breakdown characteristics with temperature variation on XLPE 6.9kV cable insulator at power plants

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**Abstract :** In this paper, we present results of the dielectric breakdown test in various 6.9kV power cables used in power plants. The dielectric strength of the different conditioned cables was measured by placing the sliced cable sections in silicone oil bath with needle electrode. The results were analyzed by the Weibull distribution. The shape and scale parameters of the Weibull distribution for each cable sections under test were calculated and evaluated. Collected data base was applied to deterioration trend analysis and lifetime guide was also proposed.

**Key Words :** Breakdown characteristics, temperature variation, XLPE, 6.9kV, cable insulator

### 1. Introduction

The most widely used XLPE power cable structure consist of conductor, conductor shield, insulation, insulation shield, neutral wire and sheath. Each layer has different function property, therefore breakdown phenomena or cable failure are caused by various defects on the cable layer. In case of 6.9kV power cable used in power plants, cable failure incidence ratio increases according to the cable's age.

In this paper, we present results of the dielectric breakdown test in three types of 6.9kV power cables used in power plants. The dielectric strength of the different conditioned cables was measured by placing the sliced cable sections in silicone oil bath with needle electrode and analyzed by the Wiebull distribution. Furthermore, physical and electrical analysis for the three types specimens are compared.

### 2. Results and Discussion

The difference scanning calorimetry measurement was used to analyze thermal characteristics of each specimens and the resluts shows ±4mW of heat flow differences at around 100°C, where melting temperature and heat capacity of aged cable is 90.5°C and 174.4J/g, respectively.

In the comparison of FTIR analysis, 5% transmittance difference was measured at 1720cm$^{-1}$ wavenumber for the specimens, which differ in the aging time. It means more carbonyl exist at aged power cable.

Dielectric breakdown strength was measured with heating oil bath. The needle electrodes with 10μm radius of curvature were inserted to insulation layer sheets by ASTM method with 2mm depth to the ground. As a results, average breakdown voltage for the aged specimen was not exceeding 27.28kV for 0.2mm sheet thickness.

Parameters of the Weibull distribution on the basis of dielectric strength data derived from laboratory tests performed on three specimens. Let $\alpha$, $\beta$ and $\gamma$ be the parameter estimates for each specimens. Parameter $\beta$ was 34.8734 and 38.6490 for new and aged specimens, respectively. Cumulative breakdown function was also increased for aged cable.

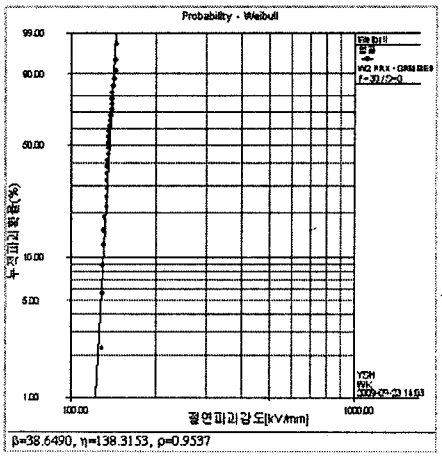


Fig. 1. Weibull distribution of aged cable

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