NUMERICAL ANALYSIS OF PARTIAL DISCHARGE BEHAVIOUR UNDER DC STRESS WITH VOLTAGE DISTURBANCE AT DIFFERENT VOID SIZES

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Abstract

Partial discharge (PD) is commonly related to electrical insulator degradation. It occurs in a high electric field environment, especially in high-voltage systems. It can lead to the electrical breakdown of insulators. Knowledge of the characteristics of PD allows for testing and monitoring of insulation properties in power system equipment. PD can be observed in both AC and DC power. However, research on AC-PD is much more mature than DC-PD due to the established pattern of AC's changing magnitude and polaritycharacteristics. This work uses finite element analysis to study PD activity under DC stresswith voltage disturbance at different void sizes, with AC harmonic as the focused disturbance.The characteristics are evaluated based on the electric potential distribution, electric

fielddistribution, electrical charges, and repetition rate. As the void radius increases from 1 mm to4 mm, the inception voltage decreases by approximately 65%, while the PD repetition rateincreases by 58%. In addition, a comparison between DC-PD and AC harmonic disturbanceand AC-PD is performed to analyze their differences. The simulation result shows that therepetition rate for DC-PD with AC harmonics is approximately 75% lower than that of AC-PD, indicating fewer PD events in the case of DC-PD with AC harmonics. The conductedsimulation provides valuable insights and guidance for the formation of DC-PD testing, andconsequently, a validated method can be approved to monitor insulating material conditionunder DC power.

Author keywords

AC harmonics; DC; FEA; Partial discharge; void

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