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Dielectric breakdown characteristics of the rod-plane electrode system in SF₆ gas under oscillating impulse voltage

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Gas insulated switchgear (GIS) has been widely used in power grid for its high reliability and small size. GIS is assembled in field considering the transportation. The AC withstand voltage testing will be taken in field to verify the insulation condition of GIS. But only the AC withstand testing is not enough to inspect the all defects inside GIS. Impulse voltage testing is required in field. But it is difficult to carry out the impulse voltage testing for the impulse voltage generator is huge. Then, IEC 60060-3 recommend the oscillating impulse voltage waveform as the field testing waveform for its high efficiency. The breakdown characteristics of SF₆ gas are not clearly under oscillating impulse voltage waveform. This paper presents the breakdown characteristics of rod to plane electrode system in SF₆ gas under oscillating voltage waveform. The oscillating lightning impulse voltage (OLI) waveform with frequency 100 kHz, 200 kHz, 300 kHz and 400 kHz are adopted as the test waveform. The rod-plane electrode system with the distance of 3.2mm is used as the specimen. The standard lightning (SLI) impulse also adopted as the reference waveform. The breakdown voltage-time (V-t) curve and breakdown probability curve are illustrated in this paper. The values of 50% and 10% breakdown voltage are obtained through statistics analysis. The results show that the 50% and 10% breakdown voltage are increase with the oscillating frequency increase. The breakdown voltage under SLI is lower than under oscillating voltage waveform. The time lag under oscillating voltage waveform is longer than under standard impulse voltage waveform. The oscillating characteristics of impulse waveform have great influence to the breakdown of SF₆.

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