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Influence of Electric Field Non-uniformity on Breakdown Characteristics in SF6/N2 Gas Mixtures Under Lightning Impulse

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In recent years, SF6/N2 gas mixtures especially with low SF6 mixing ratio was getting used as insulating medium in gas-insulated equipment for replacing pure SF6 which causes greenhouse effect. For the application of SF6/N2 gas mixtures in power equipment such as GIL, the breakdown characteristics of SF6/N2 gas mixtures in different electric field non-uniformity under lightning impulse were studied in this paper based on a fully enclosed steep-front impulse test device. The research indicates that the breakdown voltage of SF6/N2 gas mixtures increases linearly with increase of gas pressure in slightly non-uniform electric field, and the saturated trend appears with increase of the electric field non-uniformity. The reversal of polarity effect was found in SF6/N2 gas mixtures. The breakdown voltage under negative lightning impulse is higher than that under positive lightning impulse in low gas pressure, but when pressure exceeds a critical value, the result converses. The increase of SF6 mixing ratio or decrease of electric field non-uniformity would both lead to the decrease of the critical value of gas pressure. Meanwhile the change of polarity effect in SF6/N2 gas mixtures is later than that in pure gas with the increase of electric field non-uniformity. In addition, the synergistic effect of SF6/N2 gas mixtures weakens obviously with the increase of electric field non-uniformity, and the negative synergistic effect even appears with strongly non-uniform electric field.

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