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The mechanism of SF6 decomposition characteristics Under Partial Discharge at Different Gas Pressures and Voltage

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SF6 is widely applied in gas insulated switchgear (GIS) due to its excellent insulating and arcing performance. However, the partial discharge often is caused by some insulation defects because of the production, installation and operation of the GIS. Under partial discharge, The decomposition products including SO2F2, SOF2, SO2, CF4, CS2, will be formed. The types, content and change trend of products will encounter serious disagreements due to the difference of discharge type. The partial discharge can be detected by the analysis of the decomposition products of SF6. In recent years, because the method to detect the partial discharge is of a greater reduction of interferences and a higher sensitivity, the researchers pay more attention to the decomposition characteristics of SF6. In this paper, the decomposition characteristics of SF6 under partial discharge at different gas pressures and voltage level were studied. In the experiments, gas chromatography was adopted to quantitatively determine the characteristic components of decomposition. The results show that SF6 decomposition products include CO2, SOF2, SO2F2, SO2 under the needle-plate defects. The total concentration of (SOF2+SO2) and SO2F2 vary with the pressure increasing according to the rule of negative exponent, and the concentration of CO2、SOF2、SO2F2 increase linearly and gets saturated at last as the voltage increases. Then, characteristic parameters of SF6 dissociation rate is put forward to explain the SF6 gas decomposition mechanism under different pressures and voltage level. Under partial discharge, first, SF6 will decompose into SF5, SF4, SF2, etc, by electron impact-induced dissociation. The low fluorine sulfides will then react chemically with insulating material, and oxygen in SF6 to form the decomposition products. And dissociation rate affected by gas pressures and voltage controls to form stable decomposition product rate. Finally, by calculating dissociation rate, the conclusions that dissociation rate at different gas pressures and voltage level influenced the decomposition product concentration were drawn.

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