

Study on Relevance Between Electrical Tree Growth and Partial Discharges in Epoxy Resin Materials

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Abstract : Epoxy resin is widely used in the insulation of high-voltage equipment such as transformers and insulating bushings due to its good electrical insulation properties. However, manufacturing defects will cause unpredictable accidents. Therefore, it is an important issue to determine the insulation state of equipment by measuring partial discharges. In this study, the needle-plane electrode structure was used to test the epoxy resin electrical treeing insulation deterioration phenomenon. During the test, we measured the partial discharge signal and then used the signal as the input data of the insulation status assessment system, which was developed in the past research. The experimental samples were made of transparent epoxy resin to facilitate the observation of changes, and were made in the distance of 1 cm and 1.5 cm of 5 sets. During the experiment, a magnifying glass with a total magnification of 2 times is set up to enlarge the picture and a time-lapse camera is used to record the changes of the experimental samples. In the experiment, we found that the electrical treeing phenomenon of the epoxy resin insulation deterioration process can be divided into several stages: initial dark tree, filamentary tree, reverse tree, and insulation breakdown, and simply observed each stage of electrical treeing. After substituting the partial discharge signal into the insulation status assessment system, it can be found that most experimental samples were assessed into the attention period in the middle of the test and into the risky period in the middle and late of the test. Compared to the attention period signal to the recorded film, there was no obvious correlation currently, but compared to the risky period signal, we can see that the experimental sample deformed due to the temperature rise caused by the larger and more frequent discharge. Besides, we also try to collect data about different types of PD by mixing high dielectric constant materials and changing the interior constitution of the sample. Recording data like PDIV, PDEV, RPDIV, the data that recorded can improve performance of various algorithm models.

Keywords : partial discharge, insulation deterioration, epoxy resin, electrical treeing

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