MODELLING DYNAMIC PROPAGATION OF CHARACTERISTIC GASES IN TRANSFORMER OIL/PAPER STRUCTURE AND TRANSFORMER FAULT DIAGNOSTICS

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ABSTRACT

Faults in power transformers can cause decomposition of the transformer liquid dielectric and generate gases; these are known as characteristic gases. The amount and type of the generated characteristic gases can provide an indication of the type and severity of transformer fault.

Dissolved Gas Analysis (DGA) is one of the best known and most effective methods to detect transformer incipient faults. However, since power transformers are not normally in thermal equilibrium, characteristic gases migrate between the transformer liquid and solid insulation due to temperature variations; this makes it more difficult to get a picture of trends of the characteristic gases generated by the fault, and/or causes errors in fault detection by the DGA method. Little analytical or experimental work has been performed to date on the dynamic nature of this problem.

In the present research, experiments are conducted to study the migration phenomena inside the electrical insulation of power transformers. A dynamic model is suggested to explain the phenomena based on the process of diffusion. Parameters of the model are obtained by experiments. The steady-state information extracted from experiments has been compared with findings obtained from the literature. The final dynamic model is tested against experiments.

The results of this research show that the migration phenomena in the liquid-solid insulation of power transformers can be explained by diffusion equations within a reasonable range of accuracy. Findings of this research include diffusion coefficients and steady-state information of the characteristic gases in the transformer insulation system. Further implication of the obtained data are shown by analytical case studies.