High Voltage Inter-phase Barrier Pressboard Failure Analysis

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Introduction

The transformer is a very important and expensive equipment in distribution network. Any outage of the transformers cost huge amount of money. In this case, the condition monitoring of the transformer become a quite critical part.

Power transformer [1]

In the monitoring, the partial discharge is the electrical discharge that do not completely bridge the electrodes. This kind of phenomenon does much harm to the transformer like cause electrical treeing and even cause breakdown of insulation.

In order to avoid the surface partial discharge on the transformer insulator, the experiment and analysis will be carried out in the project to study what on earth happens during the surface discharge on the pressboard.

Project Aim

the aim of the project is to look at a real case where the partial discharge happens at a transformer pressboard. From the survey and some experiment, the data will be collected and then analysed. This process will include research, experiment and software simulation. After finishing the analysis, a prognostic algorithm will be tried to propose in order to alarm the similar danger before it occurs.

The failure of transformer [2]

Method

Experiment.

the experiment will try to figure out the characteristics of PD activity. In the experiment, the oil-pressboard will be applied a long-lasting AC voltage stress. The data will be collected until the first full discharge takes place. These data collection will help to understand what on earth happens when surface discharge occurs and to realize the reason of it.

Software Simulation

In order to study the surface charge performance of the inter-phase region of high voltage transformer . The real case will be set up in the Comsol to see the electrical field and magnetic field of the pressboard.

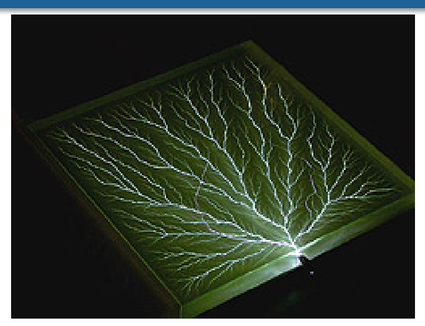
Why Does this project matter?

A paper [3] by Sokolov has summarised six surveys (i.e. by CIGRE, IEEE, EPRI, Australia-New Zealand, India Power Grid and China) on transformer failure statistics according to nine faulty components as shown in Table1. Three of the components which may be associated with failure due to problems in internal insulation systems of power transformers are tank and dielectric liquid, windings and dielectric issues, which means improvement of the insulator dielectric performance can enhance the life time and health of the transformer[4]. That is what the project will focus on.

Table1. Summary of failure surveys by a few organisations based on faulty components[4]

Faulty component	CIGRE Survey 1983 (%)	IEEE 1986 (%)	EPRI GSU US (%)	Australia-New Zealand 1985-95 (%)	India Power Grid (%)	China 220kV (Numbers)
Windings/insulation	29	41		30	73.3*	21
Dielectric issues			21			
Mechanical			11			
Magnetic circuit	11	10				4
Terminals	29	9	5			
OLTC	13			25		15
Bushing	5	13	30	19	13.3	45
Tank and dielectric liquid	13	3				16
Cooling and others		17	12		13.3	22
Total failure observed	>1000	164	45	498	15	176

Objectives



Surface discharge[5]

The objective is to achieve a deeper understanding the mechanism of the partial discharge on pressboard surfaces. The feasibility of using a prognostic algorithm which can alarm before partial discharge happens will be investigated

Flashover failure along barrier board [6]

In summary, the objective and the meaning of the project are:

1. To develop a general knowledge of the insulator(pressboard) performance in transformer under the surface discharge conditions
2. To know the performance of the pressboard under different moisture conditions
3. To have a better understanding of the surface discharge process
4. To raise a prognostic algorithm that can improve the transformer monitoring system

References

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