FRACTAL ANALYSIS OF CREEPING DISCHARGES PROPAGATING OVER SOLID INSULATORS IMMERSED IN INSULATING OIL

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Degree of Master of Science

Department of Electrical Engineering

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Signature of the Supervisor(s):

Dr. Rasara Samarasinghe Date:

Prof. Rohan Lucas Date:

Abstract

A solid/liquid insulation interface is considered to be one of the weakest points in a composite insulation system as it facilitates creeping discharges on the interface when the electric field strength exceeds a threshold value. This thesis presents an original study on the use of alternative liquid and solid insulation materials to minimize the effect of damages which occur due to creeping discharge activity. A point-plane electrode arrangement based test apparatus energized by a high voltage supply is used for analysing propagation of creeping discharges over solid/liquid interfaces using visual observation. Firstly, an algorithm is developed to determine the fractal dimension of creeping discharges propagating over various solid/liquid insulating interfaces. In particular, it focuses on the variation in creeping discharge patterns with the use of pure epoxy and Nano-composite epoxy samples. The results show that the pattern propagation depends on the surface profile and the dielectric constant of the solid material. Next, the effect of the thickness of solid materials on the propagation characteristics of creeping discharges is studied and the results show that capacitive mechanism plays a major role on pattern propagation irrespective of the kind of solid material. Next, the effect of oil level on creeping discharge propagation over solid/liquid interfaces is studied and the results show that when the oil level increase, amount of ramification and propagation of streamers decreases. Finally, this thesis studies the effect of using alternative oils such as copra type coconut oil, virgin type coconut oil, soya bean oil and sunflower oil on creeping discharge propagation. The results show that there is an inverse relationship between the amount of tree formation and the dielectric constant of the liquid. The investigations show that use of nano-composite materials and alternative oils have a significant effect on creeping discharge propagation over solid/liquid insulating interfaces.

***Keywords*-Gaseous Mechanism, Creeping Discharges, Fractal Dimension, Promotional Effect, Fractal Characteristics**

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