AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECTRICAL POWER AND MACHINES DEPT.

PERFORMANCE OF HIGH VOLTAGE SILICONE RUBBER INSULATORS UNDER WEATHER-POLLUTION CONDITIONS

A Thesis
Submitted in Partial Fulfillment for the Requirement of the Degree of Master of Science in Electrical Engineering

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master in Electrical Engineering.

The work included in this thesis was carried out by the author. No part of this thesis has been submitted for a degree or a qualification.

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ABSTRACT

Organic materials such as Polyethylene, Silicone rubbers, Epoxies and Polyesters are widely used as insulating materials for many reasons such as; economy, strength and easy fabrication to good tolerances. As result of recent developments, these materials can be produced with various electrical, thermal and mechanical properties according to their intended purpose.

Polymeric insulating materials deteriorate both mechanically and electrically due to environmental stresses such as heat, sunlight (Ultra violet), moisture and contamination. This inhibits their use near contaminated areas and along the sea coast. It is important to assess the effects of the various environmental degradation factors on the tracking and erosion performance of the material in use. Hence, the present work will present experimental results obtained regarding the electrical performance of polymeric materials under environmental conditions.

Silicone rubber is one of the important polymeric insulators which are widely used nowadays in indoor and outdoor insulation. In order to improve the performance of silicone rubber at different weathering conditions, Inorganic filler (Alumina tri-hydrate) is added to it with different concentrations to reach the suitable percentage of filler to maximize the insulator life time.

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LIST OF ABBREVIATIONS

SIR : Silicone Insulated Rubber.

H.V : High Voltage

AC : Alternating Current.

UV : Ultra Violet.

DC : Direct Current.

ATH : Alumina Tri-Hydrate.

RTV : Room Temperature Vulcanized.

HTV : High Temperature Vulcanized.

S1 : Silicone rubber sample with no filler (Virgin).

S2 : Silicone rubber sample loaded with 20% of Alumina tri-hydrate by weight.

S3 : Silicone rubber sample loaded with 30% of Alumina tri-hydrate by weight.

S4 : Silicone rubber sample loaded with 40% of Alumina tri-hydrate by weight.

S5 : Silicone rubber sample loaded with 60% of Alumina tri-hydrate by weight.

EBR : Ethylene Propylene Rubber.
PD : Partial Discharges.
SEM : Scanning Electron Microscopy.
EDS : Energy Dispersive X-ray Spectroscopy.
FTIR : Fourier Transform Infra-Red Spectroscopy.
ESCA : Electron Spectroscopy for Chemical Analysis.
RFVT : Rapid Flashover Voltage Tests.
LMW : Low Molecular Weight.

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CHAPTER 1