Ain Shams University
Faculty of Engineering
Electrical Power & Machines Department

INVESTIGATION OF DRY BAND ARCING AT INSULATING SURFACES OF RUBBER BLENDS

A THESIS

Submitted in partial fulfillment of the requirements for the degree of M.SC. in Electrical Engineering

By

Eng. **Hanaa Mohammed G. Nawar**

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Cairo (1429H-2008)

SUPERVISION SHEET

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APPROVAL SHEET

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STATEMENT

This thesis is submitted to Ain Shams University in partial fulfillment of the requirements for the degree of M.SC. in Electrical Engineering

The included work in this thesis was carried out by the author at Ain Shams University in lab of high voltage of the Power & Machines Electrical Department, the National Institute for Standards (NIS) and .

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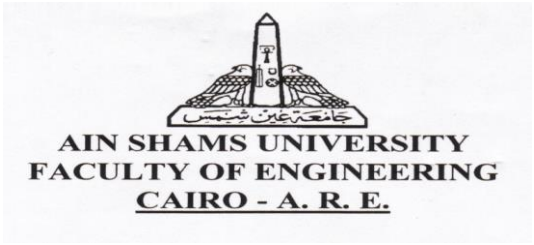
Loai Saad El-din Nasrat and Dr. Mamdouh Mostafa M. Halawa for their guidance and support. Their helpful and valuable discussions were the core reason for accomplishing this work.

?My deep gratitude goes to. for his precious advice. My very special thanks are dedicated to Dr. for his close following up, continuous advice and guidance all throughout the review of the work.

ABSTRACT



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

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

By
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B.Sc. Electrical Engineering, Ain Shams University, 2001

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Degree Name : 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 at Department of the Electrical Power Lab in Ain Shams University and the National Institute for Standards (NIS). No part of this thesis has been submitted for a degree of a qualification at any other university or institution.

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My deep gratitude goes to. **Ass. Prof. Mamdouh Mostafa M. Halawa** for his close following up, continuous advice and guidance all throughout the review of the work.

Finally, I owe a great part of research study to the H.V. Laboratory Staff in the electrical Department and to all those who assisted me in the accomplishment of this work.

ABSTRACT

Polymeric materials are increasingly being used in the manufacture of high voltage indoor and outdoor insulators in both distribution and transmission power systems.

The thesis illustrates one of the electrical phenomena on the polymer surface high voltage insulators, called "dry band arcing". This phenomenon appears on the surface of rubber blend insulators.

This study beyond to select the suitable characteristics of rubber blend insulators which resist the dry band arcing before electrical failure occurs.

Firstly, the insulator specimens are tested dry to avoid the electrical spark. Then the surface was wetted and the insulators tested again.

The wet surface helps to create a leakage current. The resistance of surface insulator decreases. As a result of leakage current, the wet surface dries and leads to increasing the resistance again. Then an arc can be occurred on air of surface insulator. The surface of insulator was carbonized. Gradually the surface specimen started to dry allowing the arc moves to the other end of specimen. This arc called dry band arcing.

During this study, many parameters of dry band arcing have been measured such as; arc resistance, resistivity and arc power of the surface insulator.

The aim of this work is to study completely dry band arcing phenomena on the surface of insulator specimens. Samples are prepared from ethylene propylene diene monomer rubber ”EPDM” and silicone rubber “SiR” with different percentage. Five Types have been prepared, 100%of EPDM, 100%of SiR, 40%SiR with 60%EPDM, 50% SiR with 50% EPDM and 60% SiR with 40% EPDM. Five samples from the same type with the same concentration are used in each test to check the trueness of the results.

The dry band arcing characteristics such as arc resistance, arc resistivity and arc power are calculated from measured data for dry band arcing voltage and dry band arcing current to select the suitable blend sample of insulating process. Several tests are studied as; dielectric strength, tensile strength and surface roughness.

The effect of arc length has been studied to evaluate the arc resistance. Also, another set of rubber blend specimens has been exposures to ultra violet rays (U.V.) with two doses (300hr&500hr), and the results have been reported.)

Finally the main salient points of this work have been summarized and presented, indicating the important of this study as polymers are presently being used worldwide in highly competitive and advance power industry. It may be recommended to use the blend percentage with 60% SiR and 40% EPDM in the industrial application.

LIST OF ABBREVIATIONS

EPDM:	Ethylene propylene diene monomer rubber.
SiR:	Silicone rubber.
S_I :	Percentage of a blend sample is 0%SiR and 100%EPDM
S_{II} :	Percentage of a blend sample is40 %SiR and 60%EPDM
S_{III} :	Percentage of a blend sample is 50%SiR and 50%EPDM
S_{IV} :	Percentage of a blend sample is 60%SiR and 40%EPDM
S_V :	Percentage of a blend sample is 100%SiR and 0%EPDM
QUV:	Accelerated weathering test performed.
V_{arc}:	Dry band arcing voltage.
I_{arc}:	Dry band arcing current.
R_{arc}:	Arc resistance.
ρ_{arc}:	Arc resistivity.
P_{arc}:	Arc power.
UV:	Ultra violet.
V_{OC}:	The open circuit voltage.
I_{SC}:	The short circuit current.