شبكة المعلومات الجامعية
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بسم الله الرحمن الرحيم

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جامعة عين شمس

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HANAA ALY

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECTRICAL POWER AND MACHINES DEPARTMENT

EVALUATING THE DIELECTRIC STRENGTH OF ELASTOMERS EXPERIMENTALLY AND BY USING ARTIFICIAL INTELLIGENCE TECHNIQUE

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

Submitted By

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B.Sc Electrical Engineering, Helwan University, 2008

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STATEMENT

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

The work included in this thesis was carried out by the author at the High Voltage Laboratory in the Electrical Power & Machines Department, the Polymers and Pigments Department in the National Research Centre (NRC). No part of this thesis has been submitted for a degree or a qualification at any other university.

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ABSTRACT

The epoxy and rubber are polymeric materials which nowadays became widely used as insulating materials for many reasons such as; better electrical and mechanical strengths, economical and ease of fabrication and maintenance. All these benefits contributed in producing polymeric materials in various shapes and designs for indoor and outdoor insulators applications with reasonable mechanical and electrical properties.

Ethylene propylene diene monomer (EPDM) is one of the composite materials that have promising electrical properties such as the electric resistivity and the dielectric strength determined by different tests, compared with other composite materials. By adding different filler percentages, the physical, electrical and mechanical properties of the composite material are enhanced.

EPDM composites are one of the best polymeric insulator composites which are widely used for cables insulation nowadays. In order to study the electrical properties for EPDM composite as cables insulation, Alumina Trihydrate (ATH) filler with different percentages are added to EPDM to enhance its mechanical, electrical and thermal properties when used under different climate conditions such as, dry, wet and salt conditions. Thus, tests have been carried out in the present work to investigate the dielectric strength for EPDM composites with various ATH loading. Further, the dielectric strength of EPDM composites have been calculated using an artificial neural network based on an investigated mathematical model.

Then, the breakdown voltage for composite insulators has been calculated using artificial neural network by the mathematical model under different climate conditions. Consequently, the results have been compared with experimental results, with the least error calculation. The best or the more reasonable composite suitable for conditions could be chosen.

Keywords: Polymers, EPDM, Fillers, ATH, Dielectric Strength, Mechanical Strength, Thermal aging, ANN

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LIST OF ABBREVIATION

EPDM	Ethylene Propylene Diene Monomer
ATH	Alumina Trihydrate
UV	Ultraviolet
NCIs	Non-Ceramic Insulators
ASTM	American Standard Test Method
MPa	MegaPascal
ANN	Artificial Neural Network
AC	Alternative Current
NSDD	Non-Soluble Deposit Density
ESDD	Equivalent Salt Deposit Density
SiR	Silicon Rubber
kV	Kilo Volt
mm	millimeter
TiO_2	Titanium Dioxide
AL_2O_3	Aluminum Oxide
$Al(OH)_3$	Aluminium hydroxide
SiO_2	Silicon Dioxide
PE	Polyethylene
MMT	Montmorillonite
XLPE	Cross-Linked Polyethylene
DCP	Distributed Control System
BDV	Break Down Voltage

FOV	Flashover Voltage
TGA	Thermal gravimetric analysis
DSC	Differential scanning calorimetry
UVA	Ultraviolet A
UVC	Ultraviolet C
PTFE	Poly Tetra Fluoro Ethylene
NaCl	Sodium Chloride
HTV	High Temperature Vulcanized
CTE	Coefficient of Thermal Expansion
ZnO	Zinc Oxide
DC	Direct Current
LDPE	Low Density Poly Ethylene
Rm	Mechanical Resistance
AVR	Average
Bt	Bentonite
HDT	Heat Distribution Temperature
EPR	Ethylene Propylene Rubber

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