

شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلو

بسم الله الرحمن الرحيم





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شبكة المعلومات الجامعية التوثيق الإلكتروني والميكرونيله



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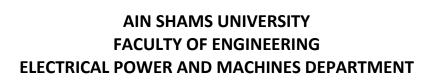


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EVALUATING THE DIELECTRIC STRENGTH OF ELASTOMERS EXPERIMENTALLY AND BY USING ARTIFICIAL INTELLIGENCE TECHNIQUE

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

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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

TiO₂ Titanium Dioxide

AL₂O₃ Aluminum Oxide

Al(OH)₃ Aluminium hydroxide

SiO₂ 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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