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**INVESTIGATION OF SURFACE
PHENOMENA ON POLYMER COMPOSITE
INSULATORS DUE TO WATER DROPLETS
UNDER HIGH VOLTAGE.**

A Thesis

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By

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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 high voltage laboratory in Electrical Power & Machines department and Polymers and Pigments department in National Research Center (N.R.C). No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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ABSTRACT

High voltage power transmission lines have acquired considerable prominence in the recent times. It has become essential to design and develop compact cost-effective and reliable insulation structures

Traditionally, line insulators have been produced using high quality glazed porcelain and pre-stressed or toughened glass. Extensive research and service experience has shown that these materials are very reliable and cost effective for a majority of outdoor applications. However, since early sixties, alternative materials namely polymers have emerged and presently are being used extensively for a variety of outdoor insulator applications because of their lightweight, high mechanical strength, less cost, reliability and superior contamination performance.

Water droplets on a polymeric surface may cause corona under the influence of an electric field and can cause deterioration to the insulation surface even in conditions of a low pollution level. The droplets increase locally the applied electric field. Local field intensifications lead to partial discharges (PD) and/or localized arcs, which may render possibly dry bands on the polymeric surface. Local arcing will eventually bridge the dry bands and a complete flashover will finally ensue.

This study investigates the influence of various parameters on the behavior of water droplets on PVC/EPDM composite material surface under electric fields. Parameters, such as polymer content, water droplet conductivity, droplet volume, and number of droplets were studied. The flashover voltage is affected by all aforementioned parameters.

Results showed that PVC material without any additions gives the best electrical performance with respect to blends of PVC / EPDM and EPDM only, increased conductivity, number of droplets and increased droplet volume cause a reduction of the flashover voltage.

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LIST OF ABBREVIATIONS

PD	: Partial Discharges
EPDM	: Ethylene Propylene Diene Monomer
EPR	: Ethylene Propylene Rubber
UV	: Ultra Violet
SR	: Silicone Rubber
PVC	: Polyvinyl Chloride
CFO	: Critical Flashover
EPM	: Ethylene Propylene Monomer
DSC	: Differential Scanning Calorimetry
TGA	: Thermogravimetical Analysis
ETFE	: Ethylene-Tetrafluorethylene
PPNCE	: Plasticized Polymer nanocomposite electrolytes
XRD	: X-Ray Diffraction
SEM	: Scanning Electron Microscope
Tg	: Glass Transition Temperature
DBS	: Dielectric Breakdown Strength
IEC	: International Electrotechnical Commission

LMW : low-molecular-weight

ASTM : American Standard Test Method

TPE : Thermoplastic Elastomer

DCPD : Dicyclopentadiene

ENB : Ethylidene norbornene

VNB : Vinyl Norbornene

kVA : Kilo Volt-Ampere

IEEE : Institute of Electrical and Electronics Engineers

NaCl : Sodium Chloride

DOP : Dioctyl Phthalate

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