DEVELOPMENT OF A METHOD TO PREDICT THE PLASTICIZER EVAPORATION OF PVC INSULATED ELECTRICAL CABLES

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Degree of Master of Science

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DECLARATION

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ABSTRACT

Though insulation is critical to the performance of an electrical cable the assessment of the status of an insulation is still a major challenge. Since the root cause of most electrical cable failures is due to insulation deterioration, if the rate of aging can be predicted, properly scheduled, appropriate maintenance programs can nearly eliminate cable failures.

The kinetics of plasticizer evaporation of polyvinyl chloride based locally manufactured electrical cable insulations were investigated. Plasticizer evaporation is a slow process under low temperatures and would take years to study under such conditions. Therefore, accelerated conditions were used to get readings within the limited timeframe. Nevertheless, data obtained under accelerated conditions was mapped to normal conditions through Arrhenius approach.

Deconvoluted derivative thermograms were used to identify the initial plasticizer percentages and Arrhenius approach was used to map accelerated condition measurements to ambient temperature evaporation rates.

As cables are subjected to time varying temperature profiles a method for finding the equivalent temperature could be developed using kinetics of plasticizer evaporation whereby the operating life of the cable can be determined. The developed method could be applied for an electrical cable under a roof which is subjected to fluctuating thermal stress throughout the day and required time to evaporate critical level of plasticizer was determined.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

PVC	Poly(vinyl chloride)
PPVC	Plasticized poly(vinyl chloride)
PB	Partial Discharge
UV	Ultra Violet
T_g	Glass Transition Temperature
EVA	Ethylene Vinyl Alcohol
GI	Galvanized Iron
PE	Polyethylene
PP	Polypropylene
CPE	Chlorinated polyethylene
PU	polyurethane
TPR	Thermoplastic Rubber
SBR	Styrene Butadiene Rubber
EPR	Ethylene Propylene Rubber
CSPE	Chlorosulfonated polyethylene
EPDM	Ethylene Propylene Diene Monomer
FEP	Fluorinated Ethylene Propylene
ETFE	Ethylene Tetrafluoro Ethylene
PVDF	Polyvinylidene Fluoride
TPE	Thermoplastic Elastomer
DEHP	Di-2-ethylhexyl Phthalate
DOP	Dioctyl Phthalate
LOI	Oxygen Index
TGA	Thermogravimetric Analysis
DTG	Differential Thermogravimetry

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