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RESEARCH ARTICLE

THERMAL PROPERTIES - ELECTRICAL INSULATING SILICONE RUBBER

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ABSTRACT

One of these days is that silicone rubber insulators used increasingly in the power industry. So knowing its behavior under different environmental conditions is of interest to industry professionals. The samples of silicone rubber were placed under electrical and thermal stress. To investigate the aging behavior of the insulation in harsh environmental conditions and provide a method to estimate the remaining life took.

INTRODUCTION

Inception of electrical science two decades ago, almost all made of china or porcelain insulators and lightning rods in containers. The performance of the insulation, especially in terms of pollution was weak. Their weight was too great and the installation of them was difficult (Hirano *et al.,* 2001). Due to frequent hot and cold, water and Ashrha trouble at lightning rods and lightning rods into moisture can penetrate. The engineers and designers sought to make better use of the materials sought are lightning rods chamber. Most of this material is silicone rubber that has been used (Heiko *et al.,* 2000). Basically, these chemical changes in the insulation, whether solid or liquid placed in the electric field is facilitated. The increased temperature makes these changes more quickly. The emergence and continued by the chemical changes, when comes the profile of electrical, mechanical and thermal insulation, such as electrical resistance, mechanical strength electrical Vastqamt to the minimum acceptable. The long shelf life makes up the insulation. To identify and select the type of insulation is important. In this study, the rapid aging tests under applied electric field and the two-stage aging conducted under high temperature that is described below. Aging specifications for silicon rubber, various experiments have been done on this insulated And the usefulness of the results is not clear, however, due to different conditions and compound materials testing, Results can hardly be compared to each other. In real terms, levels in a silicon insulator or lightning rods are covered over with dirt. Research has been done in the However, these layers are caused by disturbances in the system, But some also have the advantage that you too Chtrk damage from ultraviolet radiation in sunlight, so protect.

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Materials that are used in this research are summarized in Table 1.

Table 1. Sicone rubber compounds used in the experiments

Compound	Material
Silicon Rubber	LTV
LTV+ SiO2%17) wt(	
Silicon Rubber	
HTV+ Al(OH)3) wt%50(	HTV

General description of the silicone rubber are made in two ways:

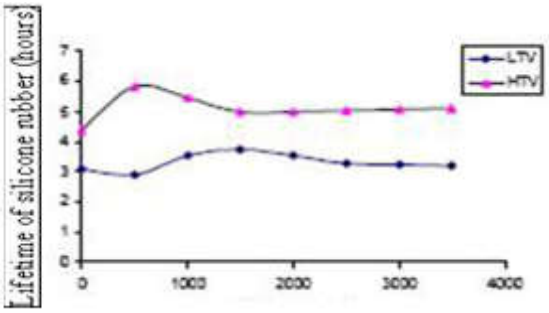
1) Silicone rubber HTV 1 Vlkanyz·h who are at high temperature.
2) Silicone rubber or RTV 2 at temperatures of LTV, which hit the bottom (room temperature) are Vlkanyz·h. Silicon is added to add that most of (ATH aluminum tri hydrate, SiO_2) Or *Al*(*OH*) is the color factor.

The accelerated aging test (Accelerated Ageing) of silicone rubber sheets, under UV radiation intensity equal to half the normal aging were accelerated. Tests for 3500 hours of aging. Using that estimate relationships throughout life, the period of 20 years of the life of insulation in a typical working conditions are evaluated. Silicone rubber samples to gauge the level of difficulty of a hard surface, Before and after accelerated aging were measured and seen all the old material from the new materials have been harder. During the first 500 hours of accelerated aging, the levels of all samples changed only slightly. But after 1000 hours, the insulation can be more rapidly begin to harden. Increased tensile strength and the length of LTV silicone rubber for the first time during 1000 declined slightly, But changes to the property only for the first

time in 2000 and then continued to decrease HTV changes stopped. Silicone rubber samples for tensile strength slightly, while being smaller than the tensile strength of the show. To summarize, the results showed that the mechanical properties of silicone rubber for all kinds of changes have been almost uniformly.

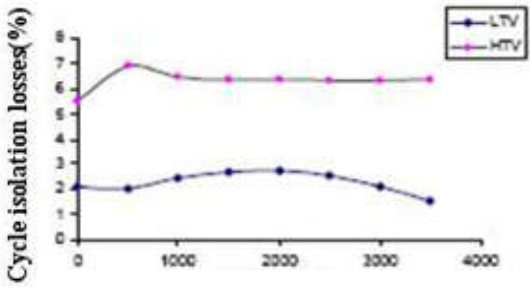
Changes in electrical properties during the aging process by ultraviolet radiation

Figures 1, 2 and 3, how to quantify changes in dielectric constant, dissipation factor, insulation resistance and the volume during aging by ultraviolet light show. As we see, characteristics, dielectric constant, dissipation factor, insulation resistance and insulation volume during the test, only a small amount of change. However, as we see, the insulation properties of silicone rubber insulation is heavily influenced by the type of properties.



Aging time (hours)

Fig. 1. Dielectric constant changes in the aging process is accelerated by UV radiation



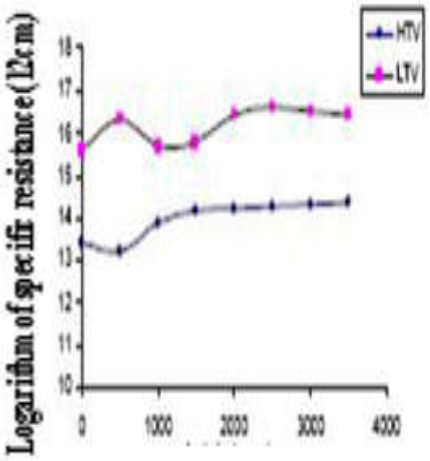
Aging time (hours)

Fig. 2. Dissipation factor of insulation aging process accelerated by changes in ultraviolet radiation

Volume resistivity for silicon is higher LTV, which is less filling. Caused small changes in the insulation loss factor, dielectric constant and volumetric resistance during accelerated aging tests, the structural changes occurring in the silicone rubber due to environmental conditions Been attributed.

Effect of aging on the glass layer of silicone rubber:

In normal conditions, the polymer insulation in some areas are experiencing high pollution. To investigate the effect of pollution layers created The aging of the insulating silicon surface during UV aging tests, rather than the pollution, A layer of dirt on the glass as it has been tested repeatedly. Results indicate that such contamination can reduce the effects of ultraviolet radiation on silicone rubber to be about 20 percent. Therefore, the insulation levels in the Gay stained with reduced levels of ultraviolet radiation to levels lower than non-infected patients are aging. It is noteworthy that the high level of pollution of surface flow and reduce the breakdown voltage insulators to be superficial (Eshkatoddini, 2002) . Another result of these tests, it was the result of the mechanical properties of silicone rubber Changes have far more than the electrical properties during the aging process is fast.

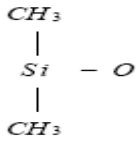


Aging time (hours)

Fig. 3. Specific insulation resistance changes in the aging process is accelerated by UV radiation

Effect of heat treatment on the silicon raw material:

Silicone polymer material, as mentioned in previous chapters, which monomer is dimethyl siloxane Plymrshdh (poly dimethyl siloxane) sold. This polymer is produced. (gum) into a liquid silicone polymer or resin main chain bonds of silicon - oxygen is made. Semi-structured organic polymeric silicone rubber that has been building semi-inorganic chemical chain it is a monomer.



It should be noted that the main factors in determining the penetration and electrical insulators Coordination between the insulators adjacent the appropriate distribution of electric field, The low penetration of electricity, it is possible, Unless our goal to build a capacitor dielectric is used as insulation (Nguyen, 2004).

Effect of heat on the cooking properties of silicone rubber

One of the steps in the preparation stage, the maker of the silicone rubber is cured. This makes the Plymrayq, to bring the necessary properties. The heat treatment temperature and time should be carefully insulated from the manufacturer of the inquiry (Meshkatoddini *et al.,* 1995). To demonstrate this effect on the properties of insulation, a silicone rubber insulation that was not the cooking temperature of 180 degrees

Celsius for two hours we had. Measurements showed that after this period, the mortality rate has dropped from 0.0052 to 0.0025.

Fig. 4.Silicone paste, cooked

Silicone rubber thermal aging test

Test equipment and examples of silicone rubber used in the experiment

For thermal testing of a programmable electric furnace in laboratory material was done using Electric Power and Water University of Technology The temperature is adjustable up to 1500 degrees Celsius. In this research, commercial, industrial silicone rubber was used in the market (Hall, 1999). This circular plates of 9 cm in diameter and 4 mm were cut. In this section, page 6 / 2 mm thickness of silicone rubber used in the experiment was done, the following portions: New pages in the lab of electrical parameters at high pressure was measured. Specific insulation resistance of a device used to measure the resistance of the insulation value migrants GB hundred ohms, respectively.

$$\rho = \frac{R.S}{d} = \frac{10^{11} \times 20}{0.24} = ٣٣/٨ \times ١٠^{١٢}$$

[Ohm.Cm]

S: area of insulation to a cm2
d: cm-thick insulation to

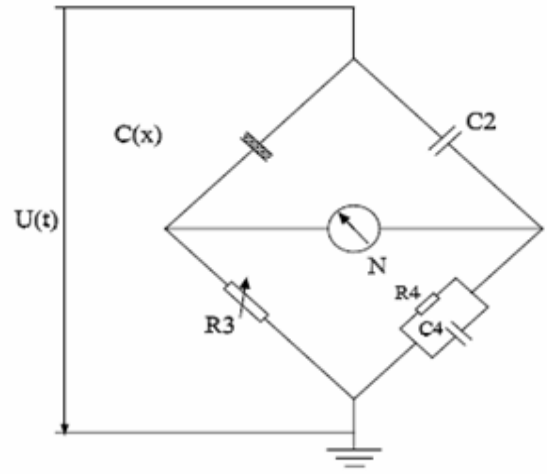


Figure 5 - Circuit Paul Forums

Hara Rty test how aging silicone rubber

To perform accelerated aging tests, samples were placed in silicone rubber in the furnace (Porali, 2003). The first sample was adjusted for temperature over 350 degrees Celsius. Because after 50 hours in temperature, loss of insulation factor of the samples did not change, this stage of the experiment was stopped And the next sample temperature was 400 ° C and the insulation loss factor was measured at different intervals . The mortality rate within 45 hours after the insulation was about one hundredth. As we know, loss of insulation factor of about ten thousandths of good insulators, insulators and insulating medium in thousandths of a bad or dirty, wet, about a hundredth. Here we measure the lifetime of the insulation, the mortality rate was one hundredth of its value. With this criterion, the useful life of insulation at a temperature of 400 ° C for 45 hours was assessed. The same procedure for other samples at higher temperatures were The results in Table 2 and Figure 7 is a chart:

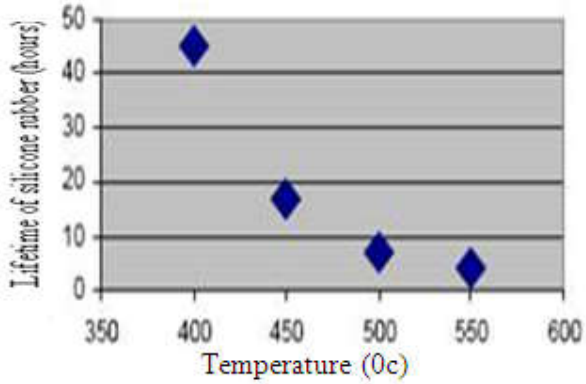


Fig. 7. Long life silicone rubber at different temperatures

Table 2. The lifetime of silicone rubber insulation at different temperatures

Temperature C	400	450	500	550
Life (hours)	45	17	7	4

Summary and conclusions

In this study, the influence of environmental conditions on the profile and aging of silicone rubber was investigated. Shown that voltage alone is applied to the sample surface breakdown voltage, in the short term has no effect on the aging of the insulation. Because the results of the tests, electrical insulation coefficient loss during aging has not changed much. That insulating silicon by applying a voltage with aging is not only In addition to the voltage applied to it, there are other factors such as heat, pollution, fog, salt, or ultraviolet radiation is also needed. Temperatures above 350 degrees Fahrenheit, causing damage and aging silicone rubber (Degradation) is. This follows the Arrhenius law, and it can help insulate the estimated remaining life expectancy. However, due to different types of silicone compounds and additives on the market, They compare the overall precision is not possible to check and test case.

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