Effect of Ultra Violet on Dry Band Arcing Behavior of EPDM Outdoor Insulators

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Abstract—This paper focuses on studying the improvement in the performance of Ethylene Propylene Diene Monomer (EPDM) which is used as outdoor high voltage insulating material by adding ATH filler. The study undertakes an investigation of the dry band arcing characteristics of the composite under un – aging condition. Also the dry band arcing characteristics of the composite have been studied under the aging condition by the exposure to Ultra Violet (UV) radiation. Tensile strength measurements are demonstrated to detect the mechanical endurance of the mixture at different composition. Investigations show that the dry band arcing characteristics of the mixture improved by an increase in the ATH filler content until (60%). Also the investigation reveals that the mechanical endurance of the mixture improved by an increase of the ATH content until (50%).

Keywords—EPDM, Dry band arcing, Tensile strength, ATH filler, Ultra Violet.

I. INTRODUCTION

The use of polymeric insulators in the electric power sub-stations, distribution, and transmission lines is beneficial because of its many advantages such as; contamination performance, reduced construction costs, light weight, easy handling, low or no maintenance, vandalism resistance, and compact design. The performance of polymer insulators depends on the selection of materials, on the design, and construction of the insulators. The pollution performance of post insulators decreased with increasing average diameter [1,2]. Silicone rubber resists the formation of a continuous electrolytic film, thereby limiting leakage current much better than EPDM and porcelain. Operating experience has proven that non-ceramic insulators perform better than porcelain in polluted conditions, this proves that the flashover voltage of non-ceramic insulators is higher than the porcelain ones. Also, laboratory tests showed significantly higher flashover voltages for both silicone and EPDM insulators compared to glass insulators [3-5].

One of the major problems with polymer insulator applications is tracking and erosion of their surface materials. This is especially the case when insulators in service are exposed to environmental contaminants. The electrical aging stresses, including leakage current and dry-band discharges are directly responsible for the occurrence of tracking and erosion. Environmental aging stresses such as; humidity, temperature variation, and UV radiation affect the polymer insulator performance through their influences on the insulator surface. Conditions cracks on the EPDM shed surface were observed as they were exposed to similar environmental stresses. The SIR insulator has a larger contact angle than the EPDM insulator, and exhibited less effect on its contact angle from environmental aging stresses[6]. Aging of polymer insulators in outdoor service starts with the loss of hydrophobicity due to weathering and then dry band arcing follows. In the case of SIR, this leads to increased current, increased surface roughness, depolymerization of the top surface layer, changes in the structure, then tracking or erosion failure, and dry band arcing will occur. Service experience has indicated that sunlight is an important factor in the degradation of polymers. This results from the breakage of certain C-C and C-H bonds by the UV radiation. This is especially true for polymers containing diene monomers. When EPDM had no UV or thermal stabilizers, the advancing contact angle decreased with increasing exposure time to UV. Polymeric materials employed to fabricate composite insulators, contain small amounts of compounds such as ZnO2 and TiO2 which absorb UV radiation and thus protect the material against damage from the radiation of the sun rays[7-9]. The absorption of the UV radiation results in mechanical and chemical degradation of the polymer structure which can affect the dielectric and weathering properties of the polymer [10,11]. Acid rain changes the surface of polymer insulators from hydrophobic to a hydrophilic surface and increasing leakage current activity.
Acid rain causes tracking and erosion of the insulator surface of housing materials which in most cases leads to a rapid failure of the insulator. ATH filler has a cooling effect when it included in polymer insulators, this helps to prevent degradation of the polymer material during dry-band arcing, also the EPDM based materials are more susceptible to degradation upon the exposure to the aging factors [12,13].

Polymeric insulators have demonstrated outstanding levels of pollution withstand voltage characteristics and they have been widely used. Fillers like silica are added to achieve good mechanical properties, also fillers like ATH are added to retard flame and improve the dielectric strength [14,15]. Aging of SIR insulators can be produced by the circulation of leakage current, producing heating of the wet contaminated insulator surface. The power of dissipation and density of the current are not uniform along the insulator surface. The water is evaporated in the higher current region forming narrow dry bands, causing significant fluctuations in the voltage distribution along the insulator. As a consequence, electrical discharges of relatively large magnitudes occur, dynamically bridging the dry bands, this is a phenomenon commonly known as dry-band arcing. Under certain conditions, the arc can become long enough to bridge the gap between the surge arresters ends causing flashover[16-18]. It is impossible to make a polluted layer so uniform so that when a leakage current flowed, one or more dry bands did not form within a short time. If several dry bands form, it is usual that after a few seconds one predominates and supports nearly all the applied voltage. The width of this dry band alters until the voltage stress across it is just less than that required to initiate a discharge in the air. Any moisture falling on the dry band distorts the electric field and the breakdown value of the air is exceeded. A surge of current results and the heat dissipated in the discharge re-establishes the dry band[19,20].

This study aims to investigate the physical, electrical, and mechanical properties of EPDM samples with different percentages of ATH filler. Also, the effect of UV on the electrical and mechanical performance of the mixture has been studied. The study focuses on trying to find an appropriate percentage of ATH filler in the EPDM sample which produces enhancements within the physical, electrical, and mechanical properties.

II. EXPERIMENTAL SETUP

A. Samples Preparation:

EPDM rubber samples have been prepared at a high temperature vulcanized in order to make a complete cross linking. Five samples of EPDM with adding different percentages of ATH filler are utilized in the experiment as indicated in table I.

<table>
<thead>
<tr>
<th>Sample symbol</th>
<th>Ethylene</th>
<th>ATH filler (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>S2</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>S3</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>S4</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>S5</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

B- Ultra Violet Test :

All samples were exposed to various doses of the UV radiation in accordance to ISO 105B01. Five samples were subjected to UV radiation for 300 hours which was extended to 500 hours for one set of samples.

C- Dry Band Arcing Test :

According to ASTM D2132-66T, the dry band arcing for EPDM samples with different ATH filler percentages (%) have been measured. Voltage (KV) and current (mA) values are recorded during the dry band arcing test for analysis. The distance between two electrodes is varying from 20mm to 30mm.

D- Tensile Strength Test:

The mechanical properties of sample were determined according to ASTM D412a-98. The tensile strength (MPa) was measured by using a 50mm/min cross head speed, tensile testing machine(model Z010) at temperatures 21 and 25 degree which made in Zwick (Germany). Five a specimens are measured for each composition.
Tensile strength (MPa) test is used to measure the ability of sample to withstand the tension force. The dimensions of the sample is 5cm length and 1mm thickness, has a dumple shape as shown in figure (1). The sample is clamped from two ends and the machine is rotating with a crossed speed of 50mm/min until the beak occurred.

Figure(1): EPDM sample for tensile strength test.

III. RESULTS AND DISCUSSION

A. Dry band arcing characteristics:
Table II illustrates various dry band arcing characteristics such as; arc voltage (KV), arc current (mA), arc resistance (MΩ), arc resistivity (Ω/ mm)×105 and arc power (W) of EPDM samples with different percentages of ATH filler (%) at length 30 mm between electrodes.

<table>
<thead>
<tr>
<th>Percent. of ATH in EPDM</th>
<th>Dry band Arcing volt.(KV)</th>
<th>Dry band Arcing Curr.(mA)</th>
<th>Arc Resistance (MΩ)</th>
<th>Arc Resistivity (Ω/mm)×10^5</th>
<th>Arc Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>10.15</td>
<td>3.5</td>
<td>2.90</td>
<td>0.96</td>
<td>7.284</td>
</tr>
<tr>
<td>30%</td>
<td>13.04</td>
<td>2.7</td>
<td>4.83</td>
<td>1.61</td>
<td>6.68</td>
</tr>
<tr>
<td>50%</td>
<td>15.33</td>
<td>2.1</td>
<td>7.30</td>
<td>2.43</td>
<td>5.735</td>
</tr>
<tr>
<td>60%</td>
<td>17.20</td>
<td>1.7</td>
<td>10.12</td>
<td>3.37</td>
<td>4.951</td>
</tr>
<tr>
<td>70%</td>
<td>11.02</td>
<td>3</td>
<td>3.67</td>
<td>1.22</td>
<td>6.632</td>
</tr>
</tbody>
</table>

Fig (2): The relationship between Dry band arcing voltage of un-aged samples and different arc lengths (30, 25 and 20mm).

B- Effect of arc length on dry band voltages of EPDM samples at un-aged condition:

The results in figure (2) show that (0% ATH) sample has the smallest value of dry band arcing voltage. While (60% ATH) sample has the highest value of dry band arcing voltage. Other samples have values in between. The value of dry band arcing voltage increases with the increase of percentage of ATH in the samples until the (60% ATH) sample, and decreases at (70% ATH) sample. This is true for arc lengths 30, 25 and 20mm.

Figure (2) illustrates the relationship between dry band arcing voltage and the percentage of ATH in EPDM samples at different lengths in un-aging condition.

It can be observed that as the amount of ATH filler increases, the dry band arcing voltage increases in all arc lengths, but in (70%ATH) the dry band arcing voltage decreases.

Also, at arc length of 30mm, it can be seen that the dry band arcing voltage of samples increases from 10.15 KV for (0% ATH) sample to 17.20 KV for (60% ATH) with an increment percentage 69.45%. And the dry band arcing voltage increases from 10.15 KV for (0% ATH) to 11.02 KV for (70% ATH) with an increment percentage 8.57%.

If the amount of ATH filler increases gradually from 30% to 50% and 60% in samples, the dry band arcing voltage will be 13.04, 15.33, and 17.20 respectively. The increment percentage of dry band voltage from a sample to another is 28.47, 51.03, and 69.45% respectively.
In 25mm arc length, the dry band arcing voltage of samples increase from 9.01 KV for (0% ATH) sample to 15.94 KV for (60% ATH) sample with an increment percentage of 76.9%, and from 9.01KV for (0% ATH) sample to 10.10 KV for (70% ATH) sample, with an increment percentage of 12.1%.

When the percentage of ATH is being increased from 30% to 50% and 60%, the dry band arcing voltage is 11.89, 14, and 15.94 respectively. The reduction percentage of the dry band voltage from sample to another is 31.96%, 55.38%, and 76.9%.

In 20mm arc length, the dry band arcing voltage of samples increase from 8.51 KV for (0% ATH) sample to 15 KV for (60% ATH) sample with an increment percentage of 76.26%, and from 8.51KV for (0% ATH) sample to 9.14 KV for (70% ATH) sample, with an increment percentage of 7.4%.

When the percentage of ATH is being increased from 30 to 50% and 60%, the dry band arcing voltage is 10.17, and 13.01 and 15KV respectively. The increment percentage of the dry band voltage from sample to another is 19.5%, 52.8% and 76.26%.

On the other hand, it can be noticed that as the arc length increases, the dry band arcing voltage increases at the same EPDM percentage, at At (0% ATH) the dry band arcing voltage value is 8.51KV at L=20mm, at L=25mm the value of dry band arcing voltage became 10.15 KV with an increment percentage of 19.27%. At (60% ATH), the dry band arcing voltage value is 15KV at L=20mm, at L=25mm the value of dry band arcing voltage became 15.94KV with an increment percentage of 6.26%, at L=30mm it became 17.20KV with an increment percentage of 14.6% . Also, the surface of samples is improved by increasing the percentages of filler, the best sample from the view of dry band arcing voltage is (60% ATH).

C-Effect of arc length on arc resistance of EPDM samples at un-aged condition:

The arc resistance is calculated by dividing voltage on current, then data is shown in figure (3).

Figure(3) illustrates the relationship between arc resistance and the percentage of ATH in samples for different arc lengths for un-aged condition.

It is noticed that (60% ATH) sample has a higher arc resistance than other samples in virgin case is 10.12MΩ at 30mm, the values of arc resistance became 8.48 and 6.52 MΩ for 25 and 20 mm respectively. It can be observed that as the arc length increased the arc resistance increased. Except in (70% ATH) sample, the value of arc resistance decreases to 3.67, 2.88, and 2.393 MΩ for 30,25, and 20mm respectively.

It is detected that (0% ATH) sample has an inferior arc resistance than other samples in virgin case, it has 2.90, 2.30, and 1.67MΩ at 30,25, and 20mm arc length respectively.

![Fig (3): The relationship between Dry band arcing resistance of un-aged samples and different arc lengths(30,25and 20mm).](image)

It can be noticed that as the amount of filler increases, the arc resistance increases in all arc lengths. Except in 70% filler as shown above. Also, it can be seen that at 30mm arc length as the percentage of ATH filler increased from (0% ATH) to (60% ATH). The value of arc resistance increased from 2.90 to 10.12 MΩ with an increment of 248.9%.

If the amount of ATH filler increases gradually from 30% to 50% and 60% in sample, the arc resistance will be 4.83,7.30, and 10.12MΩ respectively. The increment percentage of arc resistance is almost from a sample to another 66.5%,151.72%, and 248.9% respectively. The arc resistance increment increases by increasing the percentage of filler in the sample.

Further, when the percentage of ATH increased in the sample from(0% ATH) to (70% ATH), the value of Arc resistance increased from 2.90 to 3.67 MΩ with an increment 26.5% at 30mm arc length.

In 25mm arc length, the arc resistance of samples increases from 2.30 for (0% ATH) sample to 8.48MΩ for (60% ATH) sample with a percentage of increment 268%.
When the percentage of ATH is being increased from 30% to 50% and 60%, the arc resistance is 3.68, 5.81, and 8.48 MΩ respectively.

The reduction percentage of the arc resistance from sample to another is 60%, 152.6%, and 268%. Further, the arc resistance increases from 2.30 MΩ at (0%ATH) to 2.88 MΩ at (70%ATH) with an increment 25.2%.

In 20 mm arc length, the arc resistance increases from 1.67 MΩ at (0%ATH) sample to 6.52 MΩ for (60%ATH) sample with a percentage of increment 290.4%, and from 1.67 MΩ for (0%ATH) sample to 2.39 MΩ for (70%ATH) sample, with a percentage of increment 43.3%.

When the percentage of ATH is being increased from 30% to 50%, and 60%, the arc resistance is 2.91, 4.47 and 6.52 MΩ respectively. The reduction percentage of the arc resistance from sample to another is 74.25%, 167.66%, and 290.4%.

On the other hand, it can be noticed that as the arc length increases, the arc resistance increases at the same EPDM percentage. At (0%ATH) the arc resistance value is 1.67 MΩ at L=20 mm, at L=25 mm the value of arc resistance became 2.30 MΩ with an increase percentage of 37.72%, at L=30 mm it became 2.90 MΩ with an increment percentage of 73.65%, at (60%ATH) the arc resistance value is 6.52 MΩ at L=20 mm, at L=25 mm the value of arc resistance became 8.48 MΩ with an increment percentage of 30.06%, at L=30 mm it became 10.12 MΩ with an increment percentage of 55.21%.

It can be concluded that, the surface of samples is improved by increasing the percentage of filler, the best arc resistance is at (60%ATH) sample.

D- Effect of UV doses on dry band arcing voltage for samples at different exposure to aging at arc length 30 mm:

The data in figure (4) explain the relationship between dry band arcing voltages and samples with different duration to UV doses (0, 300 and 500 hrs). For un-aged samples, (0%ATH) sample has the smallest value of dry band arcing voltage, while the (60%ATH) sample has the highest value of dry band arcing voltage. Other samples have values in between as shown previously, as the percentage of ATH increased in the sample, the dry band arcing voltage increases, except the (70%ATH).

Also, for aged samples with duration (300&500 hrs) the same trend has been observed. The (0%ATH) sample has the smallest value of dry band arcing voltage, while the (60%ATH) sample has the highest value of dry band arcing voltage, but all data is reduced compared to the un-aged samples.

Figure (4) illustrates the dry band arcing voltage of samples at different exposure doses of UV at arc length 30 mm.

It can be noticed that as the amount of ATH increases in the sample, the dry band arcing voltage increases in all aging duration (300&500 hrs), except in (70%ATH) sample the dry band arcing voltage decreases. Also, for un-aged condition, it can be seen that the dry band arcing voltage of samples increases from 10.15 KV for (0%ATH) sample to 17.20 KV for (60%ATH) sample, the percentage of increment in the dry band arcing voltage is almost 69.46%. If the amount of ATH filler increased gradually from 30% to 50% and 60%, the dry band arcing voltages will be 13.04, 15.33, and 17.20 KV respectively. The percentage of increment in the dry band arcing voltage is almost 28.47, 51.03, and 69.46% respectively.

For aged duration 300 hrs, the dry band arcing voltage increases from 9.55 KV for (0%ATH) sample to 16.09 KV for (60%ATH) sample the percentage of increment in the dry band arcing voltage almost 68.48%. Also, the dry band arcing voltage increases from 9.55 KV for (0%ATH) sample to 10.62 KV for (70%ATH) sample the percentage of increment in the dry band arcing voltage almost 11.20%.
Also, For aged duration 500 hrs, the dry band arcing voltage increases from 7.84KV for (0% ATH) sample to 14.48KV for (60% ATH) sample the percentage of increment in the dry band arcing voltage almost 84.7%. Also, the dry band arcing voltage increases from 7.84KV for (0% ATH) sample to 8.71KV for (70% ATH) sample the percentage of increment in the dry band arcing voltage almost 11.09%.

On the other hand, it can be noticed that as the aged duration increases, the dry band arcing voltage decreases at the same EPDM percentage, at (0% ATH) the dry band arcing voltage value is 10.15KV at un-aged condition, at UV aged (300 hrs) the value of dry band arcing voltage became 9.55 K V with percentage of decrease 5.91%, at UV aged (500 hrs) it became 7.84KV with a percentage of decrease 22.75%. At (60% ATH), the dry band arcing voltage value is 17.20 KV at un-aged condition, at UV aged (300 hrs) the value of dry band arcing voltage became 16.09KV with a percentage of decrease 6.45%, at UV aged (500 hrs) it became 14.48KV with a percentage of decrease 15.81%.

It can be concluded that, the relationship between aged duration and dry band arcing voltage leads to by increasing the aging duration the dry band arcing voltage decreases.

It seems that, voltage loss will increase by increasing the aged duration (0, 300 and 500hrs). Also, the surface of samples is improved by increasing the percentage of filler in the sample. the best dry band arcing voltage is at (60% ATH) sample.

E- Effect of UV doses on dry band arcing resistance for samples at different exposure to aging at arc length 30mm:

The data is recorded in table (III), it has been noticed that for un-aged samples, (0% ATH) sample has the smallest value of arc resistance, while the (60% ATH) sample has the highest value of arc resistance. Other samples have values in between. As shown previously, as the percentage of ATH increased in the sample, the arc resistance increases, except the (70% ATH).

Also, for aged samples with duration (300 and 500 hrs) the same trend has been observed. The (0%ATH) sample has the smallest value of arc resistance, while the (60% ATH) sample has the highest value of arc resistance, but all data is reduced compared to the un-aged samples.

<table>
<thead>
<tr>
<th>Percent. Of ATH in EPDM</th>
<th>Arc resistance(Ω) at L=30mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Un-aged (300hrs)</td>
</tr>
<tr>
<td>0%</td>
<td>2.90</td>
</tr>
<tr>
<td>30%</td>
<td>4.83</td>
</tr>
<tr>
<td>50%</td>
<td>7.30</td>
</tr>
<tr>
<td>60%</td>
<td>10.12</td>
</tr>
<tr>
<td>70%</td>
<td>3.67</td>
</tr>
</tbody>
</table>

It can be observed that as the amount of ATH increases in the sample, the arc resistance increases in all aging duration(300&500hrs), except in (70% ATH) sample the arc resistance decreases.

For aged duration 300 hrs, the arc resistance increases from 92.53Ω for (0% ATH) sample to 9.17 MΩ for (60% ATH) sample the percentage of increment in the arc resistance almost 262.45%. Also, the arc resistance increases from 2.53 MΩ for (0% ATH) sample to 3.17 MΩ for (70% ATH) sample the percentage of increment in the arc resistance almost 25.29%. Also, For aged duration 500 hrs, the arc resistance increases from 1.44 MΩ for (0% ATH) sample to 6.96 for (60% ATH) sample the percentage of increment in the arc resistance almost 383.3%. Also, the arc resistance increases from 1.44 MΩ for (0% ATH) sample to 1.88 MΩ for (70% ATH) sample the percentage of increment in the arc resistance is almost 30.55%.

On the other hand, the arc resistance of (0% ATH) sample decreases from 2.90MΩ for un-aged condition to 2.53MΩ for 300hr aged duration and to 1.44MΩ for 500hr UV aged duration.
The percentage of decrease of arc resistance loss is almost 12.76% for 300 hrs UV aged duration and 50.34% for 500hrs UV aged duration. As well as, the arc resistance of (70% ATH) sample decreases from 3.67MΩ for un-aged condition to 3.17MΩ for 300 hrs UV aged duration and to 1.88MΩ for 500hrs aged duration. The percentage of decrease of arc resistance is almost 13.62% for 300 hrs aged duration and 48.77% for 500hrs UV aged duration.

It can be concluded that, the relationship between aged duration and arc resistance leads to by increasing the aging duration the arc resistance decreases.

Also, It seems that arc resistance loss increases by increasing aged duration. Also the surface of samples is improved by increasing the percentage of ATH filler in the sample until 60%, and it leads to decreasing the dry band arcing current. The best sample is (60% ATH) sample.

F- Mechanical Strength Measurements:

Tensile strength test is carried out and data is recorded in table(V).

Table (V) shows the values of tensile strength (Mpa) for different samples. The effect of UV doses with different duration (300&500hrs) has been investigated through this table. Also, a comparison between the un-aged and aged samples has been shown

<table>
<thead>
<tr>
<th>Percentage of ATH in EPDM(%)</th>
<th>UV Exposure Duration(Hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1.4</td>
</tr>
<tr>
<td>300</td>
<td>0.9</td>
</tr>
<tr>
<td>500</td>
<td>0.5</td>
</tr>
</tbody>
</table>

From the table, At un-aged condition, it can be observed that the value of tensile strength (Mpa) for (0% ATH) sample is 1.4%, while the value of (50% ATH) sample is 5%. Other samples at (30,60, and 70% ATH) have values of 3.89,4.02, and 1(Mpa) respectively.

After exposure the samples to UV for 300 hrs, the value of tensile strength (Mpa) for (0% ATH) sample is 0.9%, while the value of (50%ATH) sample is 3.88%. Other samples at (30,60 and 70% ATH) have values of 2.28,3.35, and 0.6(Mpa) respectively.

By increasing the exposure time to UV to 500 hrs, the value of tensile strength (Mpa) for (0% ATH) sample is 0.5%, while the value of (50%ATH) sample is 3.02%. Other samples at (30,60, and 70% ATH) have values of 1.98,2.47, and 0.3(Mpa) respectively.

It can be noticed from table(V) that by increasing the time of UV exposure, the lower mechanical strength for all samples.

Firstly, for un-aged condition, the tensile strength increases from1.4% for (0% ATH) sample to 5 % for (50%ATH) sample the percentage of increment in the tensile strength almost 257.1%. Also, the tensile strength decreases from 1.4%for (0% ATH) sample to 1% for (70%ATH) sample the percentage of decrease in the tensile strength is almost 28.57%.

For aged duration 300 hrs, the tensile strength increases from0.9% for (0% ATH) sample to 3.88 % for (50% ATH) sample the percentage of increment in the tensile strength almost 331.1%. Also, the tensile strength decreases from 0.9%for (0% ATH) sample to 0.6% for (70%ATH) sample the percentage of decrease in the tensile strength is almost 33.3%.

Also, For aged duration 500 hrs, the tensile strength increases from0.5% for (0% ATH) sample to 3.02 % for (50% ATH) sample the percentage of increment in the tensile strength almost 504%. Also, the tensile strength decreases from 0.5%for (0% ATH) sample to 0.3% for (70%ATH) sample the percentage of decrease in the tensile strength is almost 40%.

It can be observed from table (V) that (70%ATH) sample has the lowest value of tensile strength in all cases. At un-aged condition, the value of tensile strength is 1%, after the exposure to UV for 300 hrs the value of tensile strength became 0.6% with percentage loss in tensile strength almost 40%. After the exposure to UV for 500 hrs the value of tensile strength became 0.3% with percentage loss in tensile strength almost 70%.

However, (50%ATH) sample has the peak value of tensile strength in all cases. At un-aged condition, the value of tensile strength is 5%, after the exposure to UV for 300 hrs the value of tensile strength became 3.88% with percentage loss in tensile strength almost 22.4%.

After the exposure to UV for 500 hrs the value of tensile strength became 3.02% with percentage loss in tensile strength almost 39.6%.
IV. CONCLUSION

The work presented in this paper has demonstrated that ATH plays an important role in the EPDM rubber. By adding 60% of ATH filler to EPDM samples, an improvement in the dry band characteristics has been achieved. Tensile strength of EPDM improved by increasing percentage of ATH up to 50% filler at un-aged and UV aged conditions.

REFERENCES


