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COMPARISON OF POLYMER INSULATORS USING ANSYS 3D SIMULATOR AND MATLAB

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Abstract— *An insulator gets contaminated under wet and polluted conditions which are reported in coastal environments and in industrial areas. Polymer insulator is a type of insulator which features good hydrophobicity and adhesive property to improve or maintain the flashover voltage. The work proposed is to compare Polymer insulator at different voltages and to compare two different Polymeric insulators using ANSYS simulation software and Matlab.*

Keywords—*Room temperature valcanized, silicon rubber insulator, simulation of polymer insulator, 3D simulation of Insulator,Simulation RTV insulator*

I. INTRODUCTION

Insulator is very important part of power system. It provides isolation from earth and other phase or circuit. Main properties of insulator are flashover voltage and life span of insulator. Major type of insulators are Ceramic insulator which is made of glass or porcelain, Polymer insulator which is made of SR or EPR, Composite insulator which is made of a glass fiber reinforced resin rod with crimped end fittings, which carry the mechanical load and it is covered with a polymer housing. Outdoor insulator gets contaminated due to deposition of water, snow, salt or other pollutants. Due to contamination flash over voltage and life span of insulator is decreased. Polymer insulator which is made of silicon rubber consist hydrophobic properties which repel water due to which contamination of insulator is decreased. Ceramic insulator is not consists such kind of property because of which it has low flashover voltage and life span compare to polymer insulator. Silicone rubber has been used for many decades as housing material for composite insulators and for the cable accessories due to its unique features like substantial stability at high temperatures, hydrophobic properties, good UV radiation resistance and high elasticity. In this paper polymer insulators which is already been tested in paper [1] and which are used for mathematical modeling in paper [2] is simulated using ANSYS software and in paper [6] four different polymer insulator is simulated using Ansys software out of which two insulator's simulation is used here to compare and to plot the graph of insulator discs Vs voltage distribution, insulator discs Vs electric field intensity and insulator discs Vs current density.

II. SAMPLE

The samples are the short samples of FXBW- 500/160 dc SIR composite long rod insulators, which are denominated by Type A and E. The profiles and technical parameters of the samples are shown in following Table 1, in which *D*1 is the diameter of larger shed, *D*2 is the diameter of smaller shed, *h* is the arcing distance, *L* is the leakage distance, *d* is the diameter of rod, *S* is the ratio of the leakage distance to the arcing distance, *N*1 is the number of larger sheds and *N*2 is the number of smaller sheds.

Table 1 Dimensions of insulators

Type	D1/D2(mm)	h(mm)	L(mm)	d(mm)	N1/N2
A	175/87.5	2195	7393	39	26/50
E	190/110	3600	13100	45	39/78

III. RESULTS OF SIMULATION

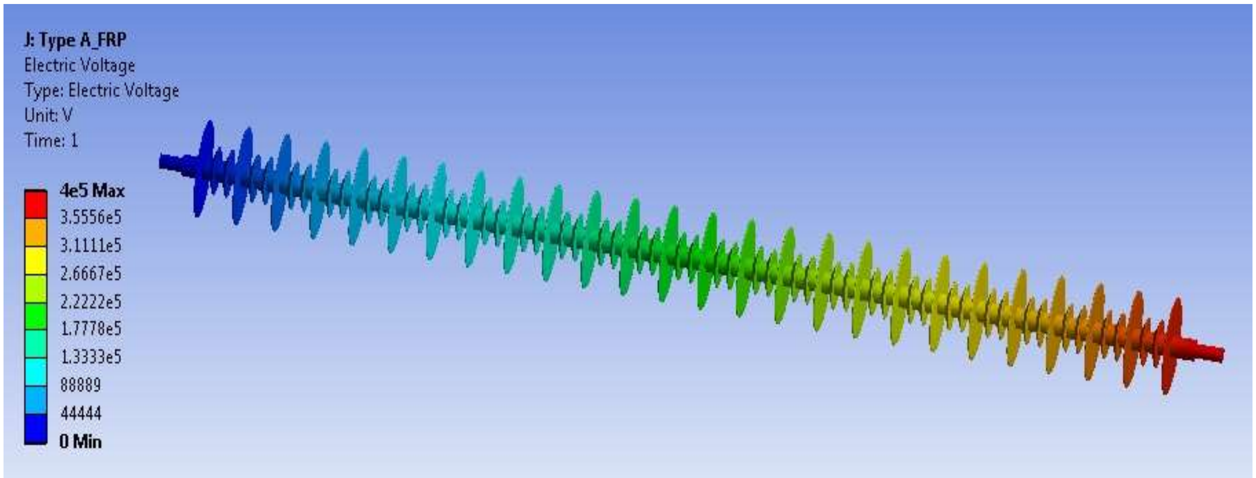

Figure 1 Voltage distribution in type A insulator at 440KV

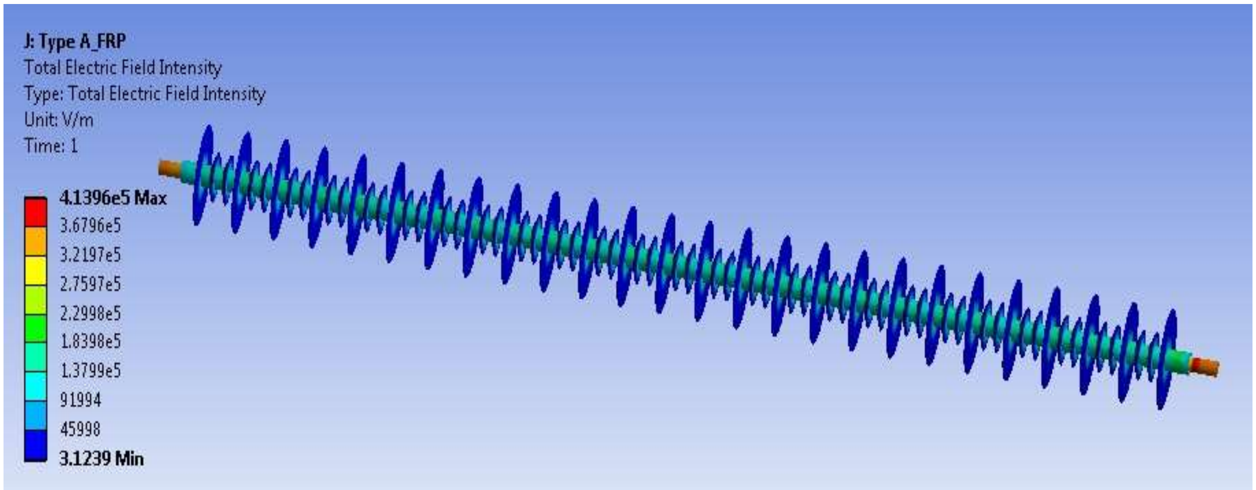

Figure 2 Electric field intensity of type A insulator at 440KV

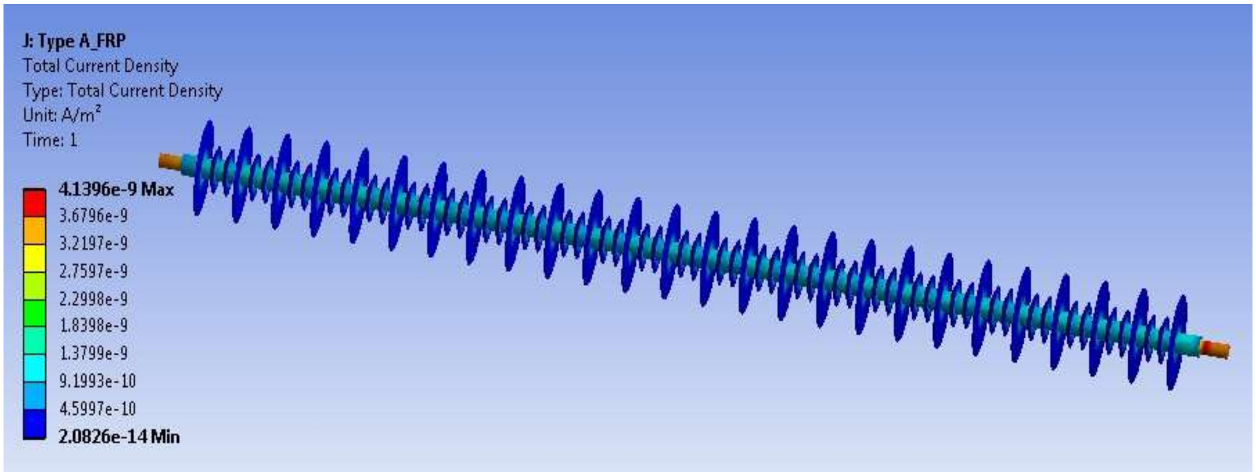

Figure 3 Current density of type A insulator at 440KV

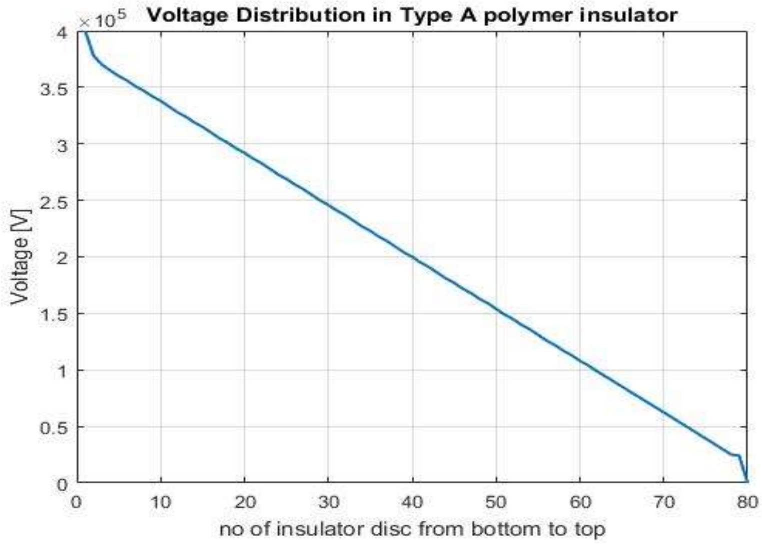

Figure 4 Voltage distribution in type A insulator at 440KV

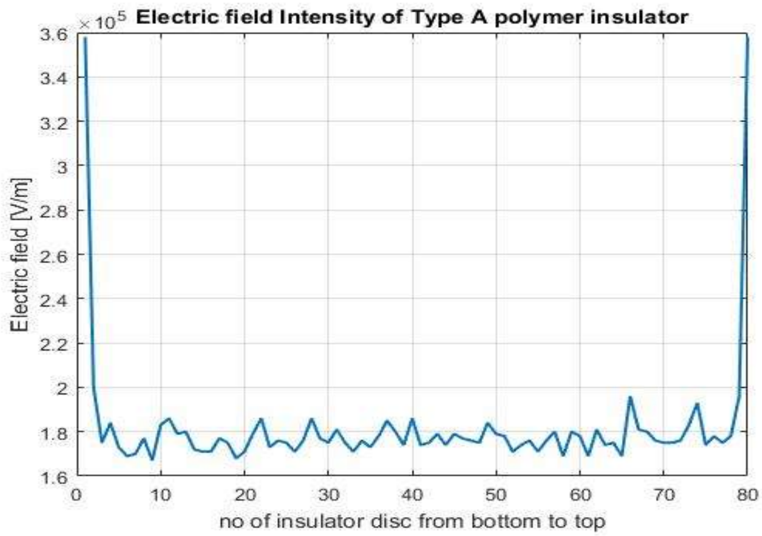

Figure 5 Electric field intensity of type A insulator at 440KV

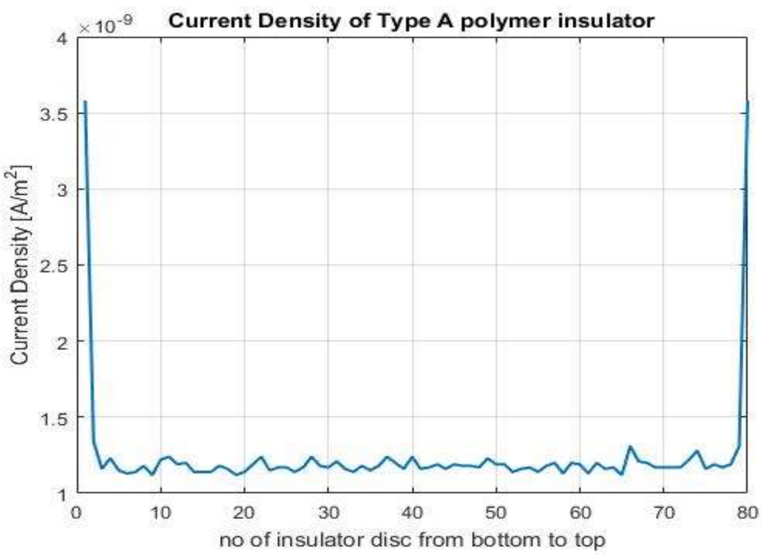

Figure 6 Current density of type A insulator at 440KV

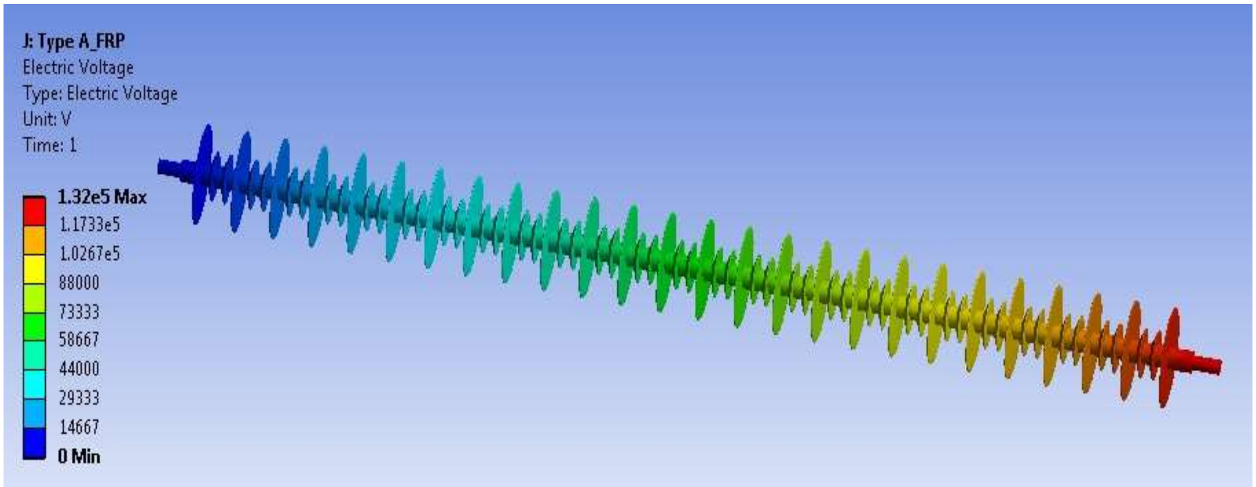

Figure 7 Voltage distribution in type A insulator at 132KV

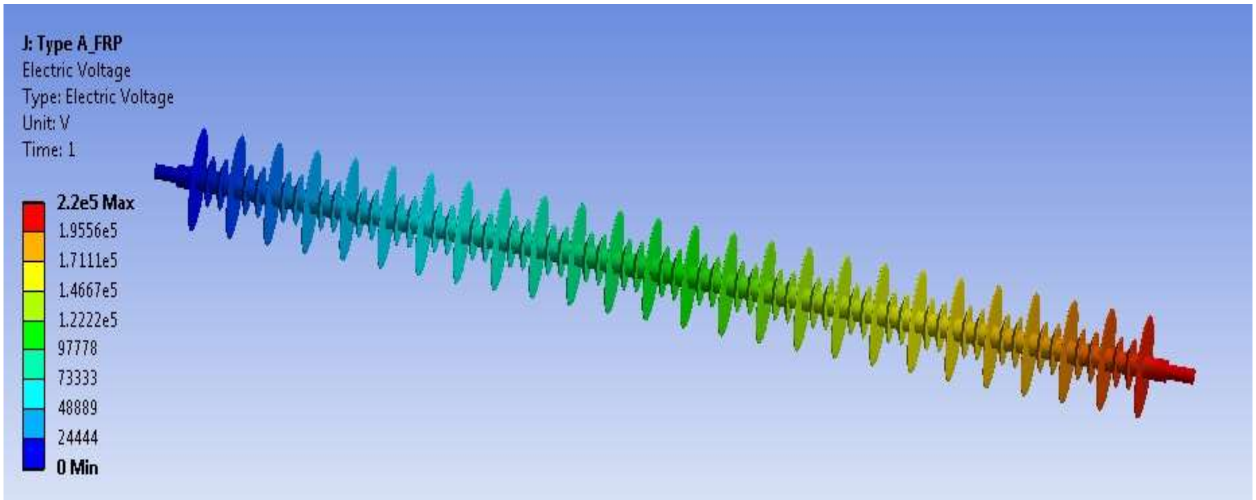

Figure 8 Voltage distribution in type A insulator at 220KV

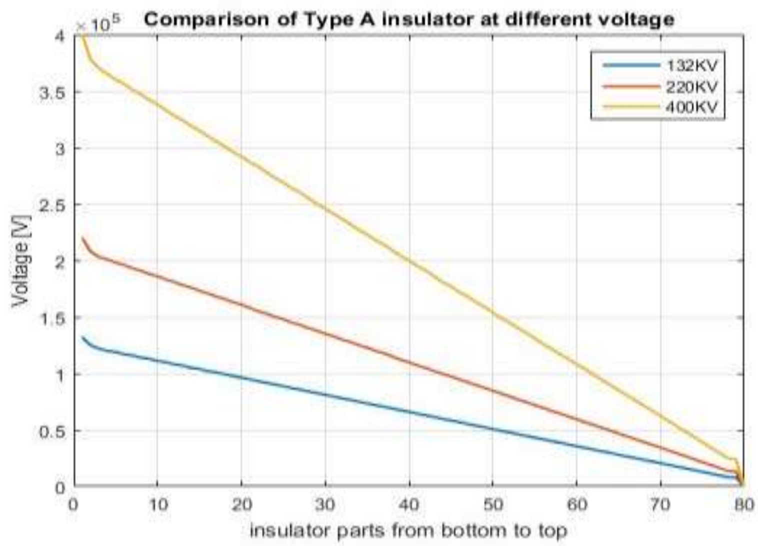

Figure 9 Comparison of type A insulator at different voltages

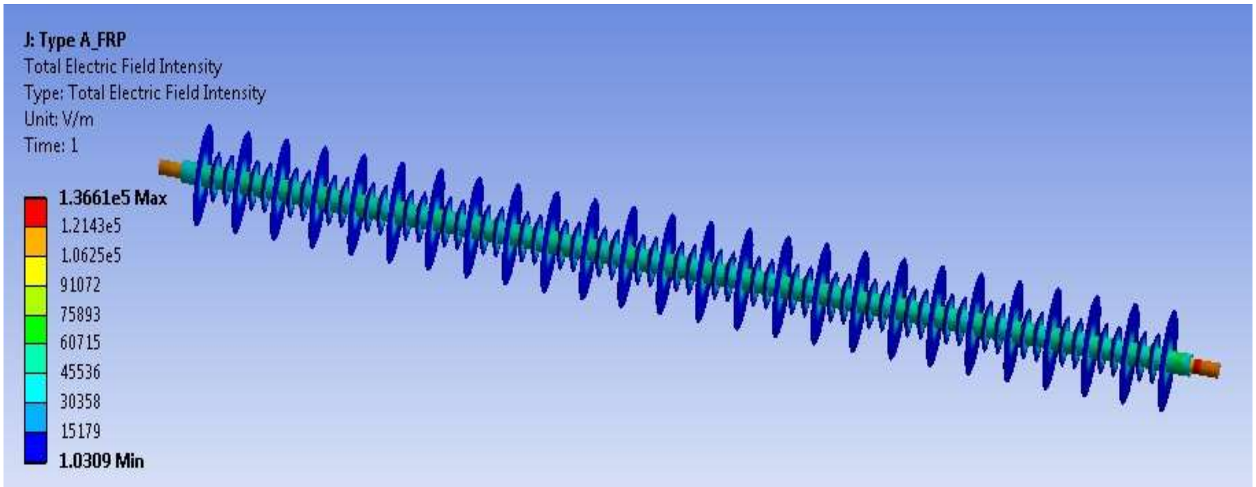

Figure 10 Electric field intensity of type A insulator at 132KV

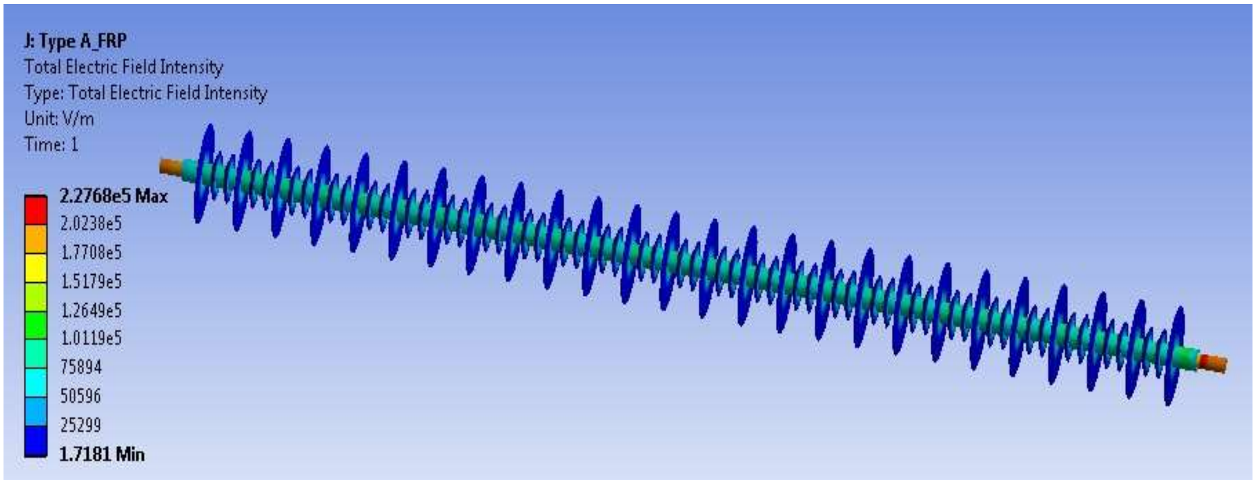

Figure 11 Electric field intensity of type A insulator at 220KV

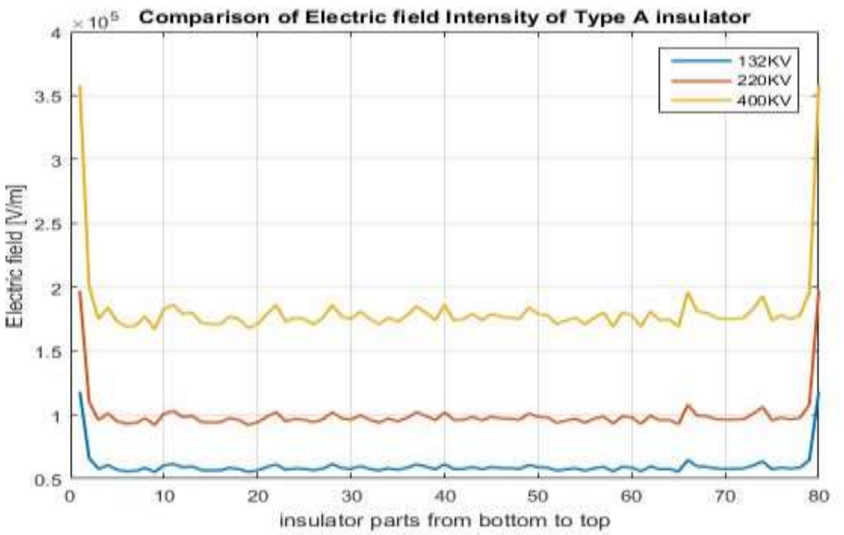

Figure 12 Comparison of electric field intensity of type A insulator at different voltages

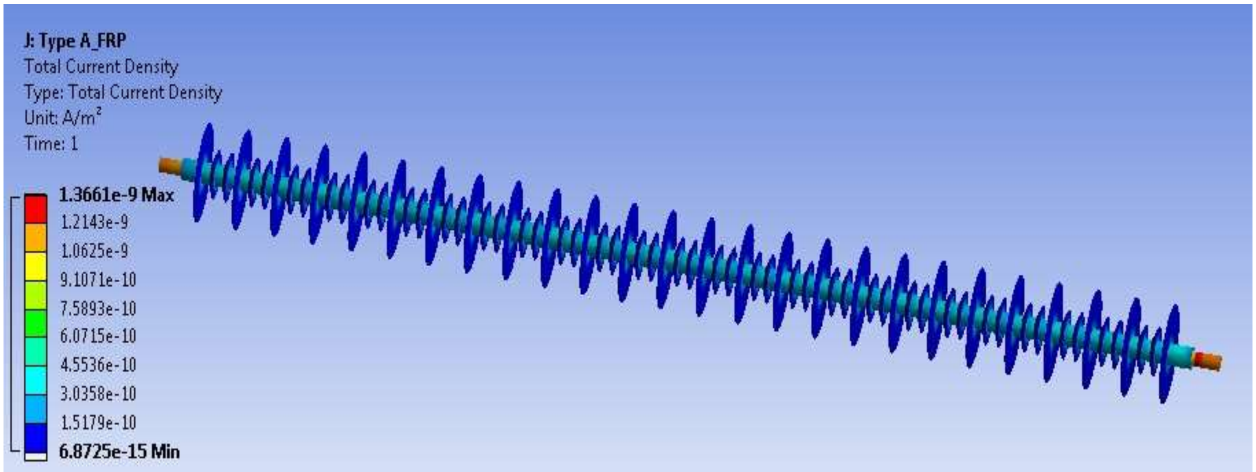

Figure 13 Current density of type A insulator at 132KV

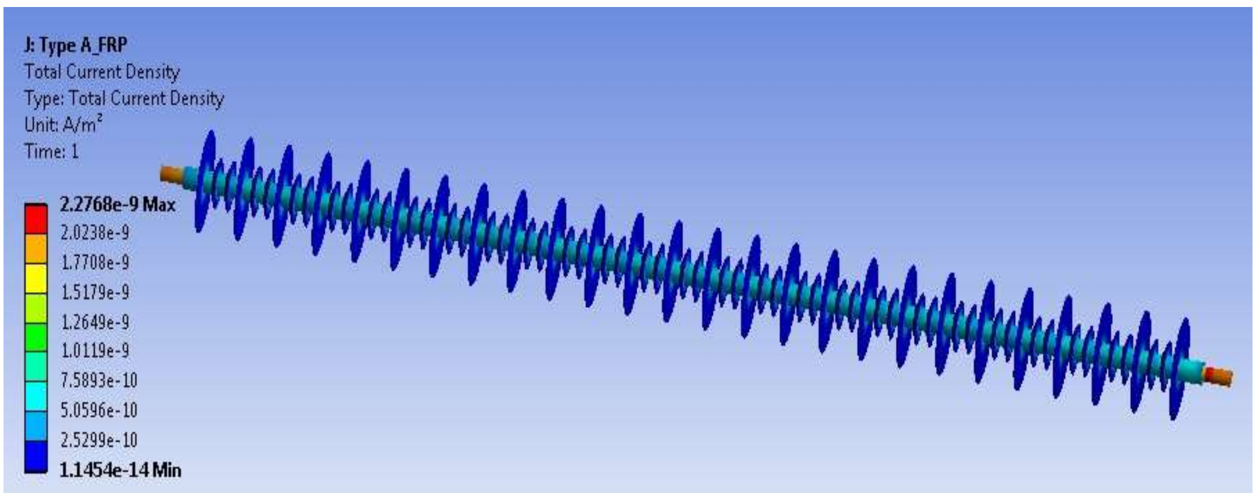

Figure 14 Current density of type A insulator at 220KV

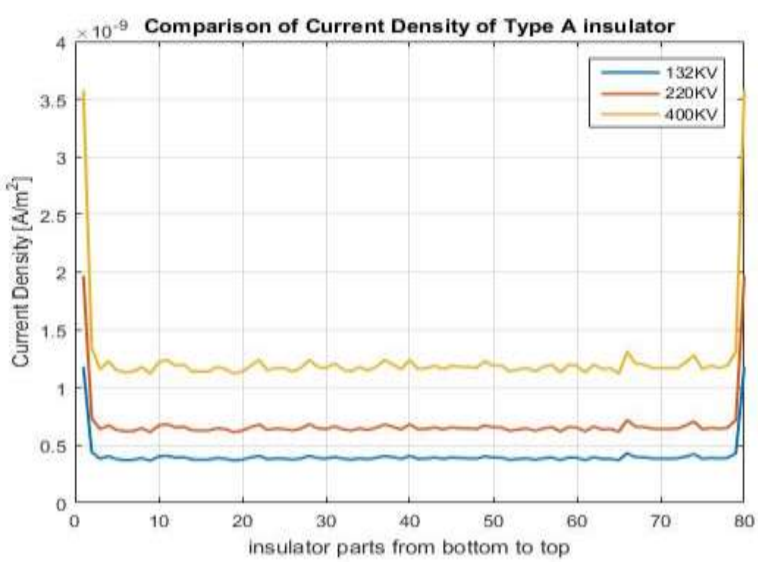

Figure 15 comparison of current density of type A insulator at different voltages

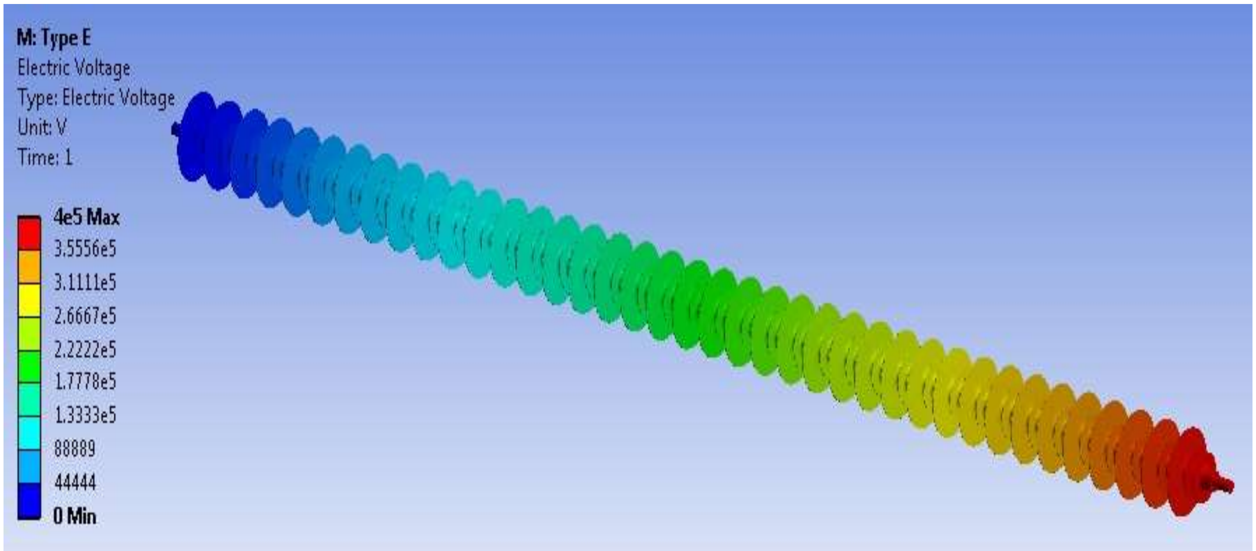

Figure 16 Voltage distribution in type E insulator at 440KV

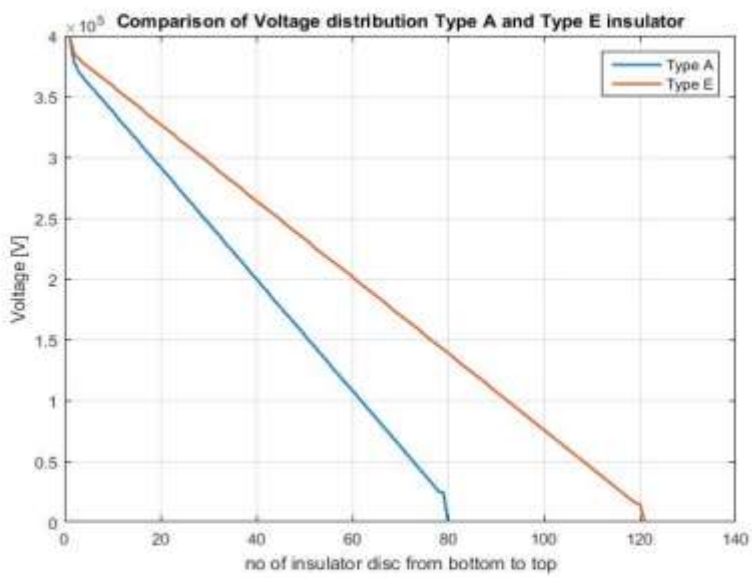

Figure 17 comparison of voltage distribution of Type A and E insulator at 440KV

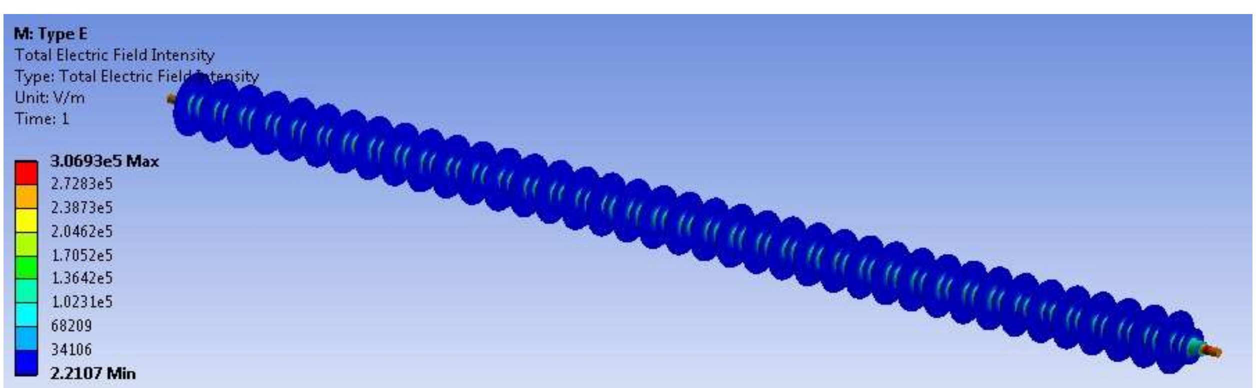

Figure 18 Electric field intensity of type E insulator at 440KV

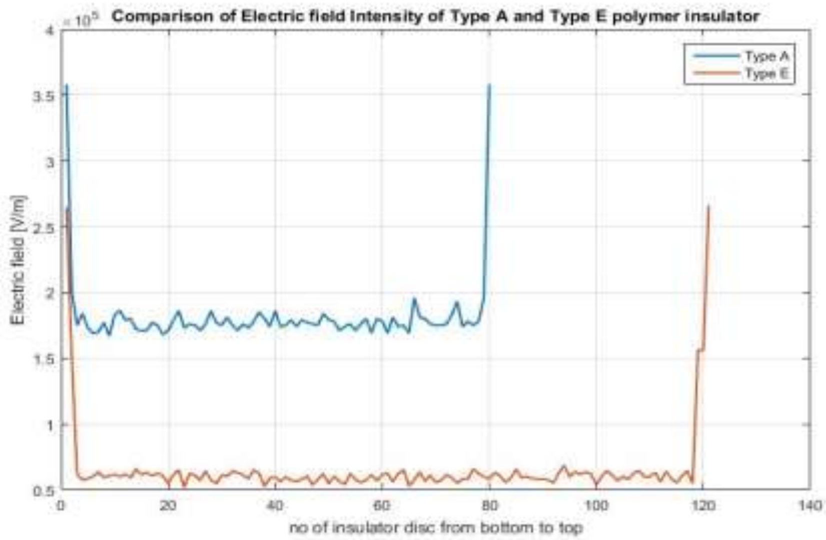

Figure 19 comparison of electric field intensity of type A and E insulator at 440KV

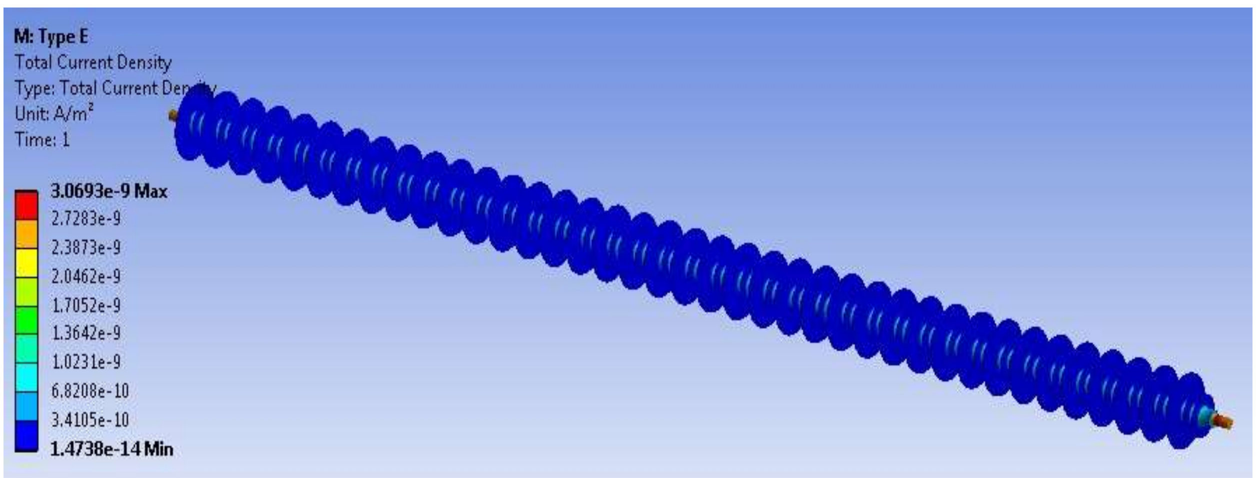

Figure 20 Current density of type E insulator at 440KV

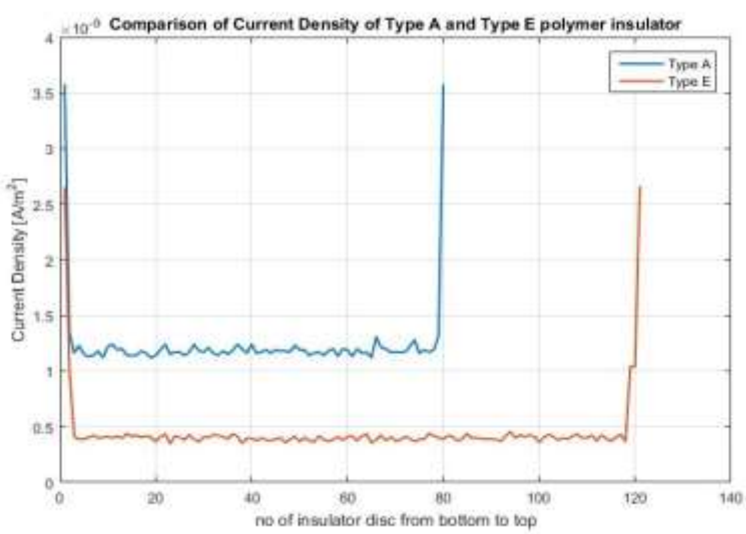

Figure 21 comparison of current density of type A and E insulator at 440KV

IV. DISCUSSION OF RESULTS

Type A insulator is simulated at voltage 132KV, 220KV and 440KV while type E insulator is simulated at 440KV and results obtained are shown in above figures. In every simulation the bottom most part of the insulator is put on maximum voltage (132KV, 220KV or 440KV) and top most part of the insulator is maintained at ground potential. The results that obtained for each type of insulators are voltage distribution, electric field intensity and current density. Also the graph is plotted for each result verses the insulator disc. From the simulation and graph of the voltage distribution of each insulator it can be seen that as we move from bottom to top of the insulator voltage is gradually decreasing. The electric field intensity of each insulator is also shown in above figures from which it can be observed that the field intensity is high at both ends of the insulator and equal in rest of the rod of the insulator. This is due to the capacitance effect and electric field intensity in the rod indicate the leakage current which is also observed in the figures of current density in insulators. This leakage current is very small and it can be ignored. Due to this leakage current there will be heat dissipation due to the high resistivity of silicon rubber which is also simulated and show in above figures. From the comparison of Type A and Type E insulator it can be conclude that as we increased the no of insulator disc voltage distribution gets linear and leakage current is reduced.

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