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INVESTIGATION THE POLARITY EFFECT AND THE VOLTAGE BREAKDOWN IN SMALL AIR GAPS

Annotation:

In this paper, a new method of the polarity result in link to the corona current and also the ground effect in small rod-plate and rod-rod air voids is presented. The impact of the polarity of the used voltage to the corona start voltage or the breakdown voltage of tiny rod-plate and rod-rod air gaps is examined. Two kinds of anode pole has actually been researched in this paper with different ranges of voltage and air space ranges. The impact of the grounding is one of the electrode to the area circulation, and also subsequently to the corona onset and the breakdown voltage of little air voids is likewise investigated by speculative experimental analysis.

Experiment:

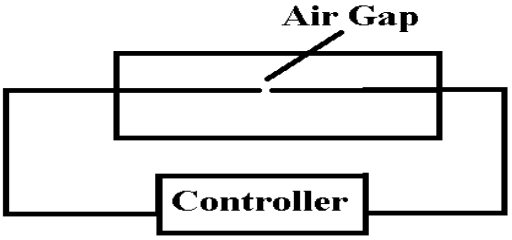

Fig. 1: Schematic diagram of the System

Figure 1 illustrated the electrical system of the air gap breakdown, which consist of controller and air gap two testing rod for corona current. There are many system in the past used for the air gap testing [1-3].

There is first testing between the plane surface barrier anode and cathode which has 5cm distance. Each of the experiment performed three times to obtain the average values of the testing. There is table 1 and 2 illustrated the experimental breakdown with positive and negative polarity effect.

Table 1

Rod Anode Positive Polarity Effect

Distance, cm	**U Breakdown 1, kv**	**U Breakdown 2, kv**	**U Breakdown, Mean**
1	100	84	96
2	80	88	84
3	60	60	60
4	48	40	44
5	40	36	38

Table 2

Rod Anode Negative Polarity Effect

Distance, cm	**U Breakdown 1, kv**	**U Breakdown 2, kv**	**U Breakdown, Mean**
1	140	104	122
2	124	92	108
3	611	60	88
4	104	44	64
5	44	32	38

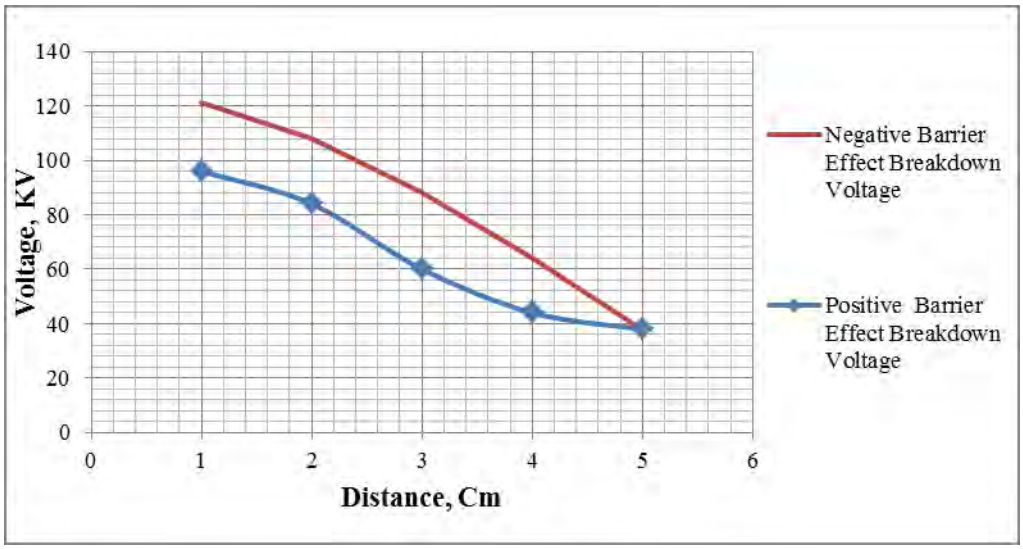

Fig. 2: Graphical presentation of anode positive and negative polarity

Polarity Effect in DC Breakdown Voltage:

There is second case for polarity effect in dc breakdown voltage positive and negative. In the second case the anode is sharp rod and cathode is plane surface barrier. There are the following experimental results in the table 3 and 4. The maximum distance between the anode and cathode is 1-7cm.

Table 3

Sharp Anode Positive Polarity Effect

Distance, cm	**U Breakdown 1,kv**	**U Breakdown 2,kv**	**U Breakdown 3,kv**	**U Breakdown Mean, kv**
1	12	12	12	12
2	24	24	24	24
3	16	18	16	33.34
4	20	20	48	38.66
5	22	26	22	46.66
6	26	28	26	53.34
7	30	26	26	54.66

Table 4

Sharp Anode Negative Polarity Effect

Distance cm	**U Breakdown 1,kv**	**U Breakdown 2,kv**	**U Breakdown 3,kv**	**U Breakdown Mean, kv**
1	12	16	16	13.34
2	16	16	20	34.66
3	30	24	30	56
4	40	38	38	77.34

5	48	48	50	97.34
6	58	58	58	116
7	68	64	64	130.66

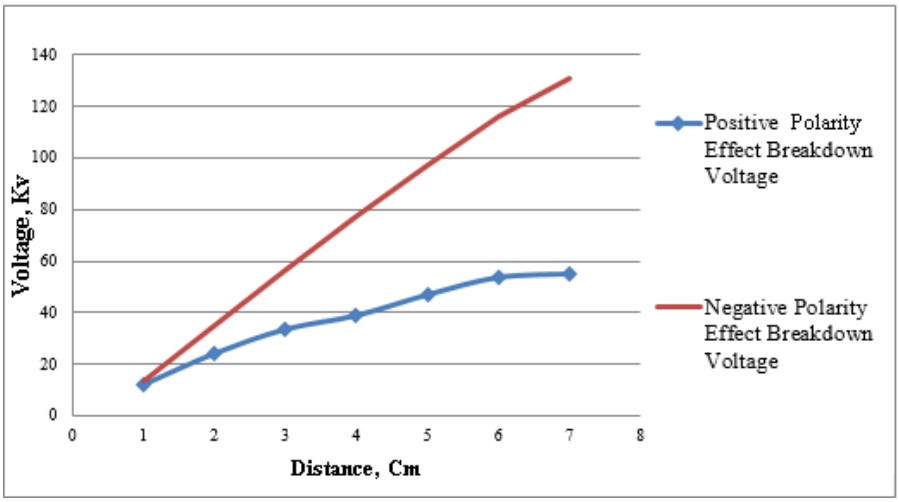

Fig. 3: Graphical presentation of anode positive and negative polarity

Result and Discussion:

The air spaces are very important insulating setups for high voltage applications (high-voltage line, electrostatic filters, electrostatic painting, and so on). The primarily used air spaces are the sphere-sphere, the rod-rod (or point-point), as well as the rod-plate (or the point-plate) air gaps with one electrode grounded. In the rod-plate air spaces the plate is usually grounded.

One of the most determinant aspect for the dielectric practices and particularly for the dielectric toughness of an air gap is the inhomogeneity of the electric area, and especially the optimum value of the field strength in the void, which typically appears on the sharper edge of the electrodes, mostly on the suggestion of a rod. Other elements are the polarity and also the kind of the used voltage as well as the corona results, which occur when the area strength exceeds some certain value. In much less homogenous electric fields like the small air spaces with reasonably large diameters of the electrodes, the corona results do not appear prior to malfunction. The values of the failure voltage depend upon the quality of the area's inhomogeneity, and specifically on the maximum value of the field toughness. The even more inhomogeneous the area is the lower the failure voltage ends up being.

In most applications the air voids are made use of with one electrode emphasized by high voltage, while the various other is based (at planet capacity). Specifically, the rod-plate setups are normally gotten in touch with home plate grounded. In such geometry, a various circulation of the electrical

field as well as different maximum values Rod Plates of the field stamina are observed in comparison to the arrangement where both electrodes are electrically charged with opposite charges. This sensation is the Ground Impact and also is quite different from the Polarity Result, although it is affected by it. The Polarity Effect is known as the phenomenon that affects the dielectric behaviour of reasonably longer rod-plate air voids with home plate based, when the polarity of the used DC voltage is changed.

According to the Polarity Result the of the breakdown voltage of the gaps are analogically higher when the polarity of the applied DC voltage is negative. The corona impacts are much more extreme and the corona current via the void is additionally analogically greater when the polarity of the voltage is negative.

There is five point computations of failure voltage of barrier result for both positive and negative polarity, the range between sharp rod as well as surface plate is 5cm, It suggests the distance in between anode as well as cathode is 5cm. In the very first Positive polarity Barrier Effect the value of voltage is raised according to range worth. The initial estimations at 1cm range the atmosphere air pressure is really low and the break down voltage is extremely high (Table 1 & 2). The failure voltage is inversely proportional of distance. The worth of malfunction voltage is reduced according to increase in distance, due to the fact that the electromagnetic disturbance is decreasing.

There are two situations of polarity impact positive and negative. In the polarity instance the failure voltage as well as range are straight proportional to every various other. In the negative polarity the preliminary malfunction voltage began with 12 V but according to raise in range the value of failure voltage is enhanced. At the final point of computations of negative polarity the malfunction voltage is around 130.66 v Table (4). The space of increased the break down voltage is increased. In the positive polarity case the value of break down voltage is exact same at first factor like negative breakdown voltage. However after increased in distance the gap of failure voltage is reduced as compared to negative failure voltage (Table 3).

The Values of the Corona voltage with the rod-plate air space is greatly influenced by the Ground Impact. It is higher when home plate is based and also lower when the pole is grounded, as it is expected according to the analysis results. The charts in Figure is for DC voltage of either positive or negative polarity. But in both cases of the exact same figure the pole has the same Polarity positive or negative in comparison to the plate.

In the case of Adverse Polarity Result the failure voltage is very high as compared to Positive barrier result (Table 4). In the case of break down voltage is reduced at the negative polarity of sharp electrical field at the sharp area brings about intensive electron cathode exhaust impact ionization as well

as large quantity of avalanches. Avalanche's electrons concerning anode shed a speed are caught by neutral molecules changing to negative ions. Positive ions create quantity cost at the sharp which increases area at the sharp decreasing electric toughness in the gap. As result failure voltage is higher at the negative polarity of pole.

In the rod-plate air gaps with the plate based the corona current is larger as well as the malfunction voltage greater when the polarity of the used voltage is negative. This is the well-known Polarity Result. A relation in between the values of the malfunction voltage and the corona current via the void exactly before malfunction emerges.

Conclusion:

In this paper, there are three main points,

The inhomogeneity of the electric field and the maximum value of the field strength in rod-plate and rod-rod air gaps are strongly affected by the geometry of the electrodes, the length of the gap, and the corona charges.

There is a connection between the breakdown voltage and the corona current through the gap just before breakdown

The Polarity of the applied voltage influences the values of the breakdown voltage in longer air gaps (Polarity Effect). It is proved that the Polarity Effect is clearly connected to the corona current through the gap just before breakdown. The corona current is higher when the rod is negatively charged, and so is the value of the breakdown voltage.

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