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3.5. Effect of corona on polymer insulator

Corona discharges occur on the surface when electric field intensity exceeds the breakdown strength of air, which is around 15 kV/cm. Atmospheric conditions which effect corona generation are air-density and humidity. The geometry of insulator itself has a role in the initiation of corona activity. The Corona generates ultraviolet light, heat, and gaseous byproducts (ozone, NO_2).

The corona discharges subject the insulator to severe electrical strains and chemical degradation. Continued degradation may render the polymer ultimately unusable. A polymer insulator must have the right chemistry to be able to withstand this chemical degradation throughout its service lifetime. The other undesirable effects of corona are noise generation, TVI, RI, ozone generation and the loss of energy.

When corona generation occurs on a wet surface, this results in 'wetting corona activity'. Wetting corona activity is the outcome of a non-uniform wetting causing high electric field. This activity depends on the type and magnitude of wetting as well as on the intensity of surface electric field. The magnitude of wetting depends on the surface characteristics (hydrophobic or hydrophilic) and on the type of wetting whether it is produced by rain, mist, fog or condensation. Magnitude of surface electric field depends upon the dimension of grading ring, its position, live-end hard wares and end fittings.

Wetting corona activity occurs mainly at live and ground terminals. Lower hydrophobicity makes discharge activity more likely. Besides the undesirable effect discussed earlier, corona in the presence of water generates nitric acid ($NO_2+H_2O=HNO_3$) which may cause surface deterioration [9].

Wind, dust, rain and salt precipitation all these factors can change the insulating material physically by roughening and cracking and chemically by the loss of soluble components and by the reactions of the salts, acids, and other impurities deposited on the surface. Surfaces become hydrophilic and water penetrates in the insulating materials causing material breakdown. As obvious from the Fig.1, nearly all the factors result in decrease of electrical strength. The electrical, physical and chemical properties of the surface of the polymer insulators are critical to the reliable performance of the insulators throughout its service plan. The practical significance of the polymer breakdown cannot be over-emphasized [4,10]. So it is very important to predict the effects of aging on these X-tics of insulator.