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Experimental Investigation on Humidity Effects on the Variations of Positive DC Corona Discharge

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Corona effects and its related electromagnetic environment on the operated conductors are important problems for high voltage transmission lines. The climate environment is quite complex in China, HVDC transmission lines may go through many high relative humidity areas,consequently, the corona performance of HVDC transmission lines will be greatly affected.

In the present paper, a corona effects testing system with the wire-to-plane electrode was built in the outdoor environment, the purpose of which is to study the influence of relative humidity on corona performance of DC conductors. Based on the testing system, the photon counting rate, the electric field strength and the ion current density at the ground level were measured by the UV imaging detector, the rotating DC electric field mill and the Wilson plate respectively. The relatively humidity during the experiments was kept within the range 40% to 80%. Moreover, the effect of relative humidity on the measurement accuracy of the field mill was also investigated in artificial climate chamber within the relative humidity 40% to 90%.

The outdoor experimental results indicated that the corona discharge intensity increased with the raise of relative humidity; hence, the corona inception voltages reduced while the photon counting rate and the total electric field increased. The change of relative humidity had slight effect on the ion current density, which kept invariant basically. It was also found that the original value of the field mill would be affected by the change of relative humidity, the higher the relative humidity was, the greater original value of the field mill would be.

On one hand, the water molecule around the DC conductor will be charged as a result of the ionized field, which will affect the electric field in the neighborhood of the conductors. On the other hand, due to being charged or airflow blowing, the water molecule deposit on the surface of the conductors, which may change the conductor surface conditions. The influences of relative humidity on space charge distribution and the surface roughness degree of the conductor are the main reasons for the variations of corona performance.

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