

Insulation decrease due to the increase of water film conductivity formed on ice and icicles accreted on sheds of insulator

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Water film¹ is effective material of ice, icicles and snow accreted insulators on their insulation characteristics. The conductivity of water film on ice and icicles performs significantly in the process of insulation decrease and then flashover mechanism of ice and icicles accreted insulators. Direct measurement of the conductivity of water film on ice and icicles is severe measurement. Therefore, we measured the conductivity of water film indirectly as the estimation supposed from data of dripped water from water film on ice and icicles accreted insulator sheds.

The experiments were carried out in cold room under experimental conditions as follows: temperature in cold room = -6 °C, wind speed = 5.3 m/s, icing period = 30 min., conductivity of salt water for icing = 450 $\mu\text{S}/\text{cm}$, measurement interval of conductivity for dripped water from water film = 5 min.. Data were collected with PC acquisition system. Specimen insulator is a chain of 3 suspension insulators with 250 mm ϕ sheds installed in suspension situation.

Fig. 1 shows one of the results that shows the relationships between temperature in cold room and conductivity of water dripped from water film on ice and icicles depending on elapsed time. The conductivity is higher than the salt water during icing period because of the mechanism of ice crystal formation from water including impurity, as a salt particle. However the conductivity during melting period around $T = 0^\circ\text{C}$, was much higher than that during icing period because of melting of ice including high concentration of salt particles during melting period in figure. Maximum conductivity was about 1800 $\mu\text{S}/\text{cm}$ that is 4 times higher against that of salt water. Therefore, it is seen clearly that severe electrical insulation conditions for ice and snow accreted insulator are around 0°C of temperature after icing and snowing.

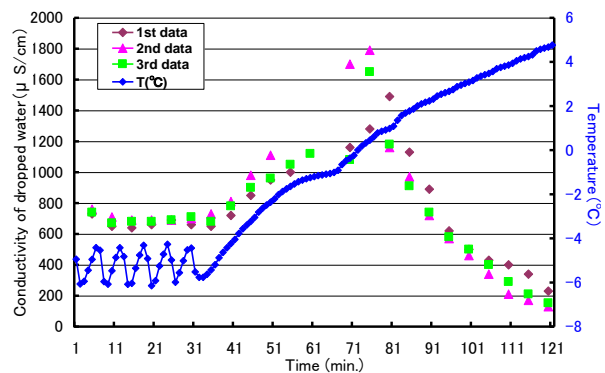


Fig. 1: Conductivity of water dripped from water film formed on ice and icicles accreted insulator sheds depending the elapsed time from icing and melting processes using salt water of which the conductivity is 450 $\mu\text{S}/\text{cm}$. Icing:0-30, Melting:30-.

¹ N. Sugawara and M. Farzaneh, "On the role of water film in the mechanism of flashover of iced insulators", Conference Record of 1986 IEEE Int. Sym. on Elec. Insul., p. 281-284, 1986.