Numerical Modelling of Needle-Grid Electrodes Negative Surface Corona Charge System

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Surface potential decay measurement is a simple and low cost tool to examine electrical properties of insulation materials. During corona charging stage, needle-grid electrodes system is often used to achieve uniform charge distribution on the surface of the sample. However, there is little report on the effects of geometrical parameters and voltage values of the charging system on the surface potential and its characteristics.

In the present report simulations based on gas discharging physics similar to [1] have been carried out to investigate dynamic surface charge formation. The geometry of in the model includes a 174μm radius of curvature needle setting perpendicular to a 0.5mm thickness grid electrode and a 27.5mm diameter with 50μm thickness polyethylene. The bottom surface of the polyethylene is grounded and it is 3cm and 1.5cm away from the needle electrode and grid electrode respectively. The simulations were initially performed under the following conditions: the needle electrode was set as -8000V and the grid electrode -2000V. It has been found that an impulse current appeared after 0.3μs charging which represented the corona effect. The effect of adding a grid electrode can be clearly seen from the logarithmic plot of electrons. Finally, surface charge density on the sample has been obtained.

[1] T. N. Tran, I. O. Golosnoy, P. L. Lewin and G. E. Georghiou, "Two Dimensional Studies of Trichel Pulses in Air Using the Finite Element Method", 2009 IEEE Conference on Electrical Insulation and Dielectric Phenomena, 18-21 October 2009