

Insulator Surface Charge as a Function of Pressure: Theory and Simulation

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Abstract – A two-phase equilibrium model was developed to explain the discontinuous surface charge decay versus atmospheric pressure of insulators that had been charged triboelectrically. The two-phase model is an electrostatic form of the Langmuir Isotherm for ions adsorbed on a surface in equilibrium with ions in the gas phase. In this paper, the model was extended to account for vibrational states of the adsorbed surface ions via the vibrational partition function. An analysis is performed that rules out Paschen discharge as the cause of the discharge observed. Also, a numerical simulation is performed using NWChemTM to calculate the adsorption energies of ions on insulator surfaces for comparison to curve fit adsorption energies developed from the model and experimental data.