Modeling and Simulation of a Electrostatic Precipitator System for Air Cleaning

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A coupled calculation procedure is employed for complex interactions among electric filed, the gas flow and the particulate flow within the electrostatic precipitator(ESP). A corona discharge serves as the ion source, produced by the local electrical breakdown of gas in the vicinity of electrode. A electric charge is placed on airborne particles which are driven toward collection plates under the influence of an applied electric field by the coulomb force. The fluid dynamics in the ESP is analyzed by the FLUENT 6.1 and the DPM(Discrete Phase Model) is applied to yield motion of particles. A electrostatic model is developed to yield electric field distribution within the ESP by the UDF(User-Defined Function) module. These results are used to incorporate an electric body force into a two-dimensional turbulent fluid dynamics model based upon the formulation. The mathematical model can predict motion of particles within the ESP under the influence of electric field. These results are compared with the experimental results. Presentation of the computed motion of particles is found to be quite useful to predict the precipitator performance.