Electrostatic Loss of Charged Particles in a Cylindrical Tube Connection with Electric Potential Difference

송동근*, 홍원석, 신완호
한국기계연구원
(dksong@kimm.re.kr*)

A cylindrical tube connection that has a electric voltage difference and is separated electrically by an insulator was modeled, and electrostatic loss of charged nanoparticles passing through the connector tube was numerically investigated. Typically, as the particle size decreases and the applied voltage difference increases, the electrostatic loss increases. To assess the effect of the electrode geometry, various lengths of electric insulator W, tube diameter D, total connection length L and aerosol flow rate Q_a were used when investigating electrostatic loss. The fluid flow was assumed to be fully developed laminar flow, and the electric field was solved using the Laplace equation. Particle loss was calculated by analyzing particle trajectories and comparison of electrostatic loss for various electrode geometry setups suggests that the electrostatic loss can be described as a function of a new non-dimensional parameter, E_s (= $Z_pV/U_{avg}W$), and an explicit form for electrostatic loss is provided as a function of E and given as $E_{es} = [\ 1 + E_s^{-1}\{-0.0948 + 1.4137 \exp(-0.9465\ E_s)\}\ ]^{-1}$.