Analysis of particles movement enforced by electrodynamic force for dust removal using DEM Simulation in indoors

Young H. Yoon*, Sung Youn Kim and Kwang Soo Kim

Environmental and Plant Engineering Research Institute,
Korea Institute of Civil Engineering and Building Technology, Goyang-Si, 10223, Korea
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Presenting author email: yoyoon74@kict.re.kr

The fine dust is one of the restricted IAQ (Indoor Air Quality) pollutants due to the tiny size and its reactivity, which can influence to human respiratory organs and public health in indoors. In order to control and remove these fine dust particles from indoors, the electrodynamic dust remover enforced by dielectrophoretic and electrostatic force was designed. This electric force can remove the dust particles which are charged and uncharged from surfaces and mitigate the accumulation of particles on such surface powered by 3-phased alternating current generator. Because of the particles size, their movement cannot interpret effectively through lab scale test, which consists of 3-phased alternating current power generator, electrode(flexible printed circuit board) and fine dust(PM10). Therefore, the EDEM simulator based on the DEM(Discrete Element Mothod) has been applied to find the main factors that can solve the interaction between particles.

In this paper, the experiment conditions were changed such as the falling patterns; case of falling to only circuit board; case of falling to whole board; case of falling to centre of circuit board. DEM(Discrete Element Mothod) was employed to investigate as a mean to describe the movement of fine dust particles depending on changing of experiment conditions using the simulator.

For investigation of particle movements enforced by electrodynamic force, the EDEM (produced by DEM Solution) simulator can explain and interpret the interaction and following movements of particles according to the discrete element method technique. When the force is provided to the electrodynamically heterogeneous state, the particle on the surface of electrodynamic fields may be moved to outside of electrode enforced by the dielectrophoretic and electrostatic force. Through applying the EDEM, the particle movements could be simulated to illustrate the dust removal

From the simulation results, the interaction of particles contributes to the whole movement. Through the simulation conditions were selected and changed, it is found that the size, shape and density of particles and width of electrode and force strength are can be the key parameters for dust movement to outside of electrode. All of these parameters need to apply to the system with higher degree in order to overcome the worked gravity and statical friction force of particles

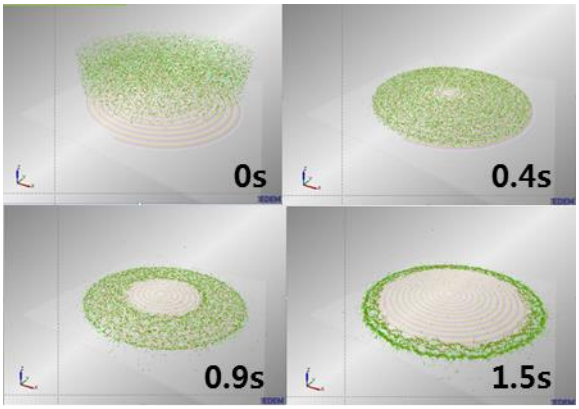

Figure 1. Simulation results of fine dust particles movement using EDEM simulator enforced by electrodynamic force.

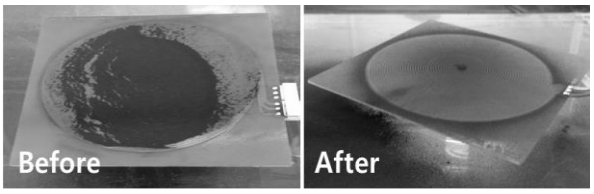

Figure 2. The experiment results of test for fine dust particles removal from electrode using activated carbon powder with supplied 3-phased alternating current: before power supply(left), and after power supply(right)

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