분말 소화장치내의 Gas-solid 흐름에 관한 이산입자 시뮬레이션

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Discrete particle simulation of the Gas-solid flow in a powder extinguishing system

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핵심용어 : 2상류, 분말 입자, 분말 소화 장치
Key Words : Two-phase flow, Powder particles, Powder extinguishing system

1. Introduction □

In this study, Lagrangian-Eulerian approach is employed to simulate and illustrate the ejection of gas-solid flow in powder gun and powder monitor of an dry powder extinguishing system. Dry powder is stored in a container tank where high pressure nitrogen gas is ejected to create a mixture. Two-components mixture is then transported through a pipeline system to the gun and monitor. In this conveyance process, the pressure and velocity variation of the mixture are observed with steady state analyses. Transient simulations are carried out to illustrate the ejection process of mixture into environments and investigate the interaction between gas and powder particles.

2. Numerical method

Particle transport modeling is a type of multiphase model. The full particulate phase is modeled by just a sample of individual particles. Within this type of approach, the total flow of particle phase is modeled by tracking a small number of particles through the continuum fluid. The particles could be solid particles, drops or bubbles. They will be calculated with momentum equations, motion equations, and acting force equations. The simulations are taken place with k-ε turbulence model. Dry powder with different-size particles is set as particle transport solid, whereas nitrogen gas is defined as continuous fluid.

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3. Results and discussion

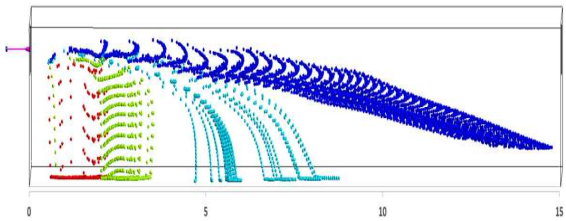

Fig. 1. Movement of solid particles in different size.

Distribution of dry powder after leaving the injection gun is displayed in Figure 1. Each group of solid particle is indicated in different colour. Total length of environment domain is 15m and it is clear that small particles can travel further than big ones.

4. Conclusions

In this research, computational simulations are conducted to perform the two-phase flow pattern, gas-solid velocity and pressure distribution, volume fraction of powder in the flow. The ejection process after the mixture leaves the nozzle is demonstrate to plot thrown distance of powder in each case of flow rate. Higher fraction of powder can cause more drag and resistance for two-phase flow. The traveling distance of particles depends on their size, small particles travel further than big ones.