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CHARACTERISTICS OF MAJOR DUST AND THEIR DIFFUSION SIMULATION DURING SUBWAY CONSTRUCTION

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Abstract

Dust generated in the tunnelling process of subway construction can severely threaten construction safety and workers' occupational health, therefore dust control and reduction through ventilation is crucially emphasized during tunnelling and subsequent construction processes. This study relied upon field construction of a subway station in Beijing, and investigated characteristics of the generated dust and their diffusion at press-in ventilation circumstance. Based upon the field study, numerical simulation using FLUENT with discrete phase model (DPM) on major influencing factors, including the distances of airflow duct away from construction working area and ventilation durations, were performed. The field study showed that the dust concentrations significantly decreased from 218.5 mg/L to 65 mg/L as the distances increased away from working area, and dust particles less than 3 μm in size made up over 90% of the total dust, which were predominated by bolt shotcrete dust. Numerical simulations illustrated that prolonged ventilation duration could enhance diffusions of dust towards outlet for both press-in and exhaust ventilations, however with clear difference on dust diffusion characteristics, and airflow vortex was considered as the major cause to dust diffusion disturbance in both ventilations. According to simulation, the optimized distances between airflow duct and working area were 20 m and 5 m, and optimized ventilation durations were 150 s and 30 s for press-in and exhaust ventilation, respectively. The results in this study could provide scientific guidance for dust control and reduction of subway tunnelling constructions in the future.

Key words: bolt shotcrete dust, numerical simulation, particle size distribution, welding fume

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