Novel Dust Removal Methods for Underground Mining
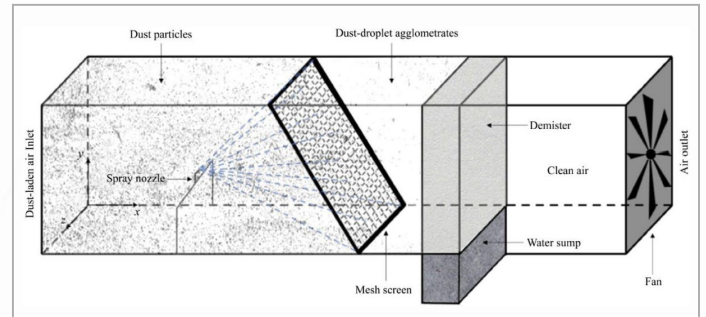
VTIP 22-113: "Filter System for Removing Dust Particles from Underground Mining and Methods of Use Thereof"
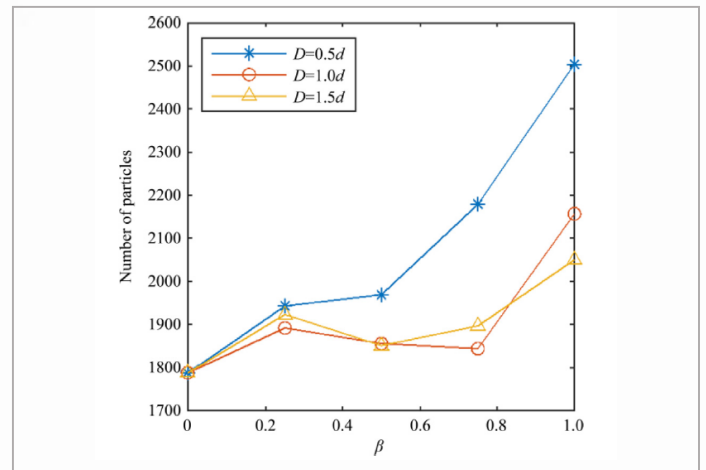
THE CHALLENGE

Dust is an inherent byproduct of any mining activity and has notable health and safety concerns. Mine operators typically employ preventative particle-collecting devices such as flooded-bed scrubbers on continuous miners in underground mines to suppress airborne dust. However, these scrubbers are plagued by problems involving clogging, and constantly require maintenance to ensure clean filters.

Schematic of the flooded-bed dust scrubber.

OUR SOLUTION

The Noble lab at Virginia Tech has developed a novel filter system for removing dust particles from underground mining. The system utilizes vibrating mesh panels within a flooded-bed dust scrubber. The vibrating panels are tuned to specific frequencies to enhance dust particle capture and promote self-cleaning. This proposed system is a direct contrast to the current static mesh screens employed within dust scrubbers, allowing for potential improvements in the overall capture efficiency, while minimizing common operational issues.

The effects of vibration conditions on the dust particle-mesh interaction as determined by computation fluid dynamic (CFD) simulations. These results suggest that the vibrating mesh allows stronger dust particle-mesh interaction than the static mesh, and the interaction becomes stronger as the vibration velocity increases (i.e., larger β), allowing for higher dust collection efficiency. Also, the smaller vibration amplitude (0.5d) outperforms the larger amplitudes (d and 1.5d) in terms of amount of number of particles captured.

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