***Spotlight Topic*:** Checking Rock Dust to Prevent Mine Explosions

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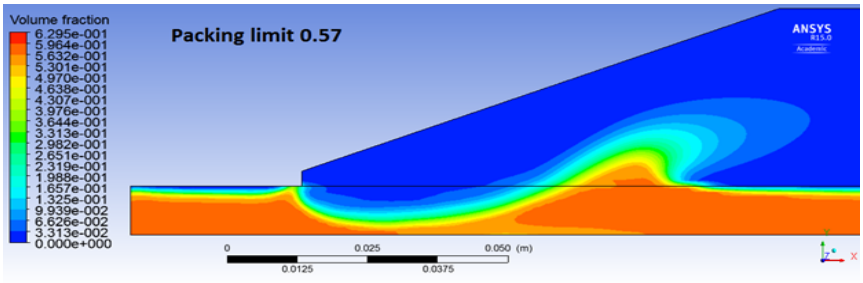
Underground coal mines face the danger of methane and coal dust explosions. The disaster at Upper Big Branch mine has demonstrated the impact of a violent coal dust explosion that fatally injured 29 miners. For the prevention of coal dust explosions, U.S. mines rely solely on powdered, inert stone dust, so-called rock dust, distributed throughout the mine entries on floor, roof and ribs. Research has shown that explosive coal dust must be mixed with at least 80% inert rock dust in order to prevent coal dust explosions.

Reviewing the history of coal dust explosions, researchers at the Colorado School of Mines found that that mine operators and mine inspectors do not have a reliable method of collecting representative samples of mine dust to assure that sufficient amounts of rock dust have been placed to inertize the coal dust. The currently prescribed sampling method using a brush and dust pan does not provide reliably accurate samples. For a meaningful sample, the mine dust particles must be entrained in air similar to the way they participate in and propagate a coal dust explosion. Any form of mechanical sample collection, for example with a brush, is unsatisfactory and invalid because it does not accurately mimic the dust entrainment process that happens in an explosion. Current MSHA guidelines require sampling mine dust with a brush and dust pan, removing the "uppermost 1/8th inch (approximate depth)." The prescribed brush action is questionable since the bristles can dislodge dust particles with much greater force compared to entrainment in air flow. Yet, only those dust particles entrainable in air will participate in an explosion. A coal dust explosion typically scours up the top 0.7 to 2.6 mm (0.02 to 0.1 inch) have shown that an only paper-thin layer (~0.12 mm) of coal dust is already sufficient to propagate a dust explosion.

This research aims to develop a pneumatic mine dust sampling device that is simple, portable, and can help underground mine examiners collect dust samples from workings. The samples can then be tested for sufficient inert content using an existing instrument, the Coal Dust Explosibility Meter (CDEM). Researchers at the Colorado School of Mines have developed a working prototype mine dust sampling device (DSD), see figure above, that will help mine operators and inspectors draw meaningful samples of mine dust. The DSD works by blowing a light puff of air over deposited coal and rock dust, entraining the dust sample in air just like a mine explosion would, and then trapping the sample for subsequent analysis of its explosibility properties. The design of the DSD was optimized using Computational Fluid Dynamics (CFD) modeling, see figure below.

Having the ability for a near instant measurements with a simple and reliable sampling instrument is especially important for small mine operators who do not have a dedicated staff of mine safety and explosion control examiners. The DSD is expected to make a significant impact in that it will provide a simple way for mine operators and examiners to verify the adequacy of rock dust covering throughout the mine.



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