Follow Up Grant AFC316FO-84: Refining silica and other dust particle classification by optical light microscopy

Initial Grant AFC316-17: Further Characterizing Respirable Coal Mine Particulates: Submicron Particles, Metals and Diesel Exhaust

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Focus of the proposed follow-on work: This project is specifically related to the Foundation's focus on *Health and Safety Interventions*, and follows directly from a recent project aimed at demonstrating the capability of optical microscopy and image processing to classify respirable coal mine dust particles.

Expected Outcome: The primary outcome of this work will be improved accuracy of respirable silica and other dust particle classification by optical microscopy. This is the next logical step toward development of the envisioned dust monitor.

We envision a portable dust monitor that uses optical microscopy to fractionate the dust into its primary components (Figure 1). Basically, a monitor would collect and compare images of dust particles in plane and cross polarized light, and use changes in features such as light intensity to classify the particles. (It should be noted that, while optical microscopy should be able to allow particle sizing in the respirable range (e.g., down to 1-2 μm), it is unlikely that much smaller particles could be accurately identified and sized—especially in a field setting. Thus, our monitoring concept is only envisioned for dust. Finer particulates, such as those sourced from diesel emissions, are not currently considered.)

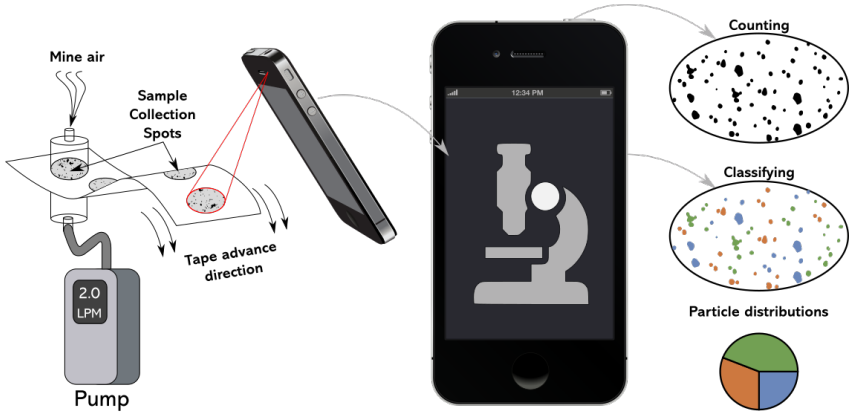

Figure 1. Conceptual illustration of coal mine dust monitor that uses a "cell-phone" microscope to count and classify particles.

Specific Aims of Proposed Research: The specific aim of this project is to improve the classification accuracy for silica, and thereby other dust particles, using the optical microscopy method.

The project objectives are to:

(1) determine the optimal range of particle density for optical microscope imaging; and, accordingly,
(2) refine the previously developed image analysis and classification models