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DEVELOPMENT AND FABRICATION OF A PROTOTYPE FIBROUS AEROSOL MONITOR (FAM)

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ABSTRACT

This report describes a program whose objective was to develop, design, fabricate and laboratory-test two prototype instruments capable of real-time selective detection and measurement of airborne fibrous-shaped particles.

The operation of this fibrous aerosol monitor (FAM) is based on the rotation imparted to the acicular particles by means of a rotating quadrupole electric field of the order of 3000 V/cm. This field induces a dipole charge separation on the fibers and aligns them with the applied field. The selective detection of the fibers is effected by synchronous detection of the resulting modulation of the light scattered from a continuous-wave helium-neon laser beam by the rotating particles.

The theory of operation, design of the electric-optical detection configuration and the electronic signal processing method are discussed. By means of a scattering pulse sharpness discrimination technique, fibers whose length exceed a selectable value are detected and their number concentration digitally displayed. Counting times of 1 to 1000 minutes permit the measurement of fiber concentrations between 0.001 and about 30 cm^{-3}. A concentration of the order of one fiber per cubic centimeter can be assessed within a relative standard deviation of 10 percent with a counting period of 10 minutes.

The FAM is a portable, battery-powered instrument capable of operating continuously for about 4 hours between battery charges. Preliminary tests with crocidolite and crysotile asbestos as well as with glass fibers were performed in the laboratory and the results indicate good correlation with the standard NIOSH phase contrast microscopy filter counting method.

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