PLAINTIFF'S
EXHIBIT
FD-234

Atmospheric Environment Pergamon Press 1970 Vol. 4, pp. 125–128. Printed in Great Britain

INTERNAL REFLECTION SPECTROSCOPY APPLIED TO AIR POLLUTION

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(*First received* 23 *May* 1969; *and in final form* 3 *August* 1969)

Abstract--Five internationally standardized samples of types of asbestos were identified by multiple internal reflectance spectroscopy in the infra-red region between 650 cm^{-1} and 4000 cm^{-1}. Previously, identification of asbestos types has required personal visual recognition through light microscopy, electron microscopy, or electron microprobe techniques.

The type of samples used in this investigation were undiluted, uncontaminated masses of large sized asbestos fibres less than 200 μm in length, similar to refined production material. The ability to identify this material in bulk, readily, can be expected to be useful when relating atmospheric asbestos fibre samples to specific sources and types.

The lower limits of resolution as to mass, fiber length, and dilution with other air pollutants will next be determined, along with methods of atmospheric samples preparation, such as a slow ashing method.

1. INTRODUCTION

SURFACE spoiling, including soiling, of materials by particulate and gaseous air pollutants is a recognized undesirable effect encountered almost daily in our environment. One type of particulate pollutant, asbestos, seems to have more than just a surface soiling effect. Asbestos fibers are generally characterized and identified by visual or electron microscopy methods requiring skilled visual observers.

A different class of instrumental technique that may be useful in identifying particulate pollutants and pollutant effects is known variously as multiple internal reflection spectroscopy and attenuated reflectance spectroscopy. Pollutants may be chemically identified using this technique by determining the infra-red absorption characteristics of the collected pollutant or its effects on some materials in the 4000 cm^{-1}–650 cm^{-1} region of the spectrum.

2. EXPERIMENTAL

Internal reflection spectroscopy was used to characterize 5 standard reference samples of asbestos obtained from the International Union Against Cancer as described by TIMBRELL, GILSON and WEBSTER (1969). These sample consisted of Amosite, Anthophyllite, Crocidolite, Chrysotile "A", and Chrysotile "B". These samples were assembled and distributed by the Pneumoconiosis Research Unit of the International Union Against Cancer primarily for biological tests of the effects of asbestos in animal experiments. The asbestos samples are fibrous in nature and approximately 200 μm in length. The Amphibole samples (Amosite, Anthophyllite and Crocidolite) fibers are coiled. The 5 standard reference samples of asbestos were all Grade IV on the Canadian scale or the nearest equivalent in order to have materials of relatively short fiber that together now account for 98 per cent of all commercially used asbestos.

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SCF-FA-6313

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