

INFRARED ANALYSIS OF ASBESTOS QUALITATIVE AND QUANTITATIVE

M.V. Zeller
S.C. Pattacini

Summary

The increased commercial use of asbestos has warranted the airborne fiber as being a health hazard to the general public. Infrared offers a very convenient method of identifying the crystalline form of asbestos that is polluting the atmosphere of interest. One may also use the infrared spectrum to measure the amount of asbestos that is collected. The detection limit for a 13 mm KBr pellet of the chrysotile form of asbestos is determined to be 10 μg .

DETECTION LIMIT OF ASBESTOS

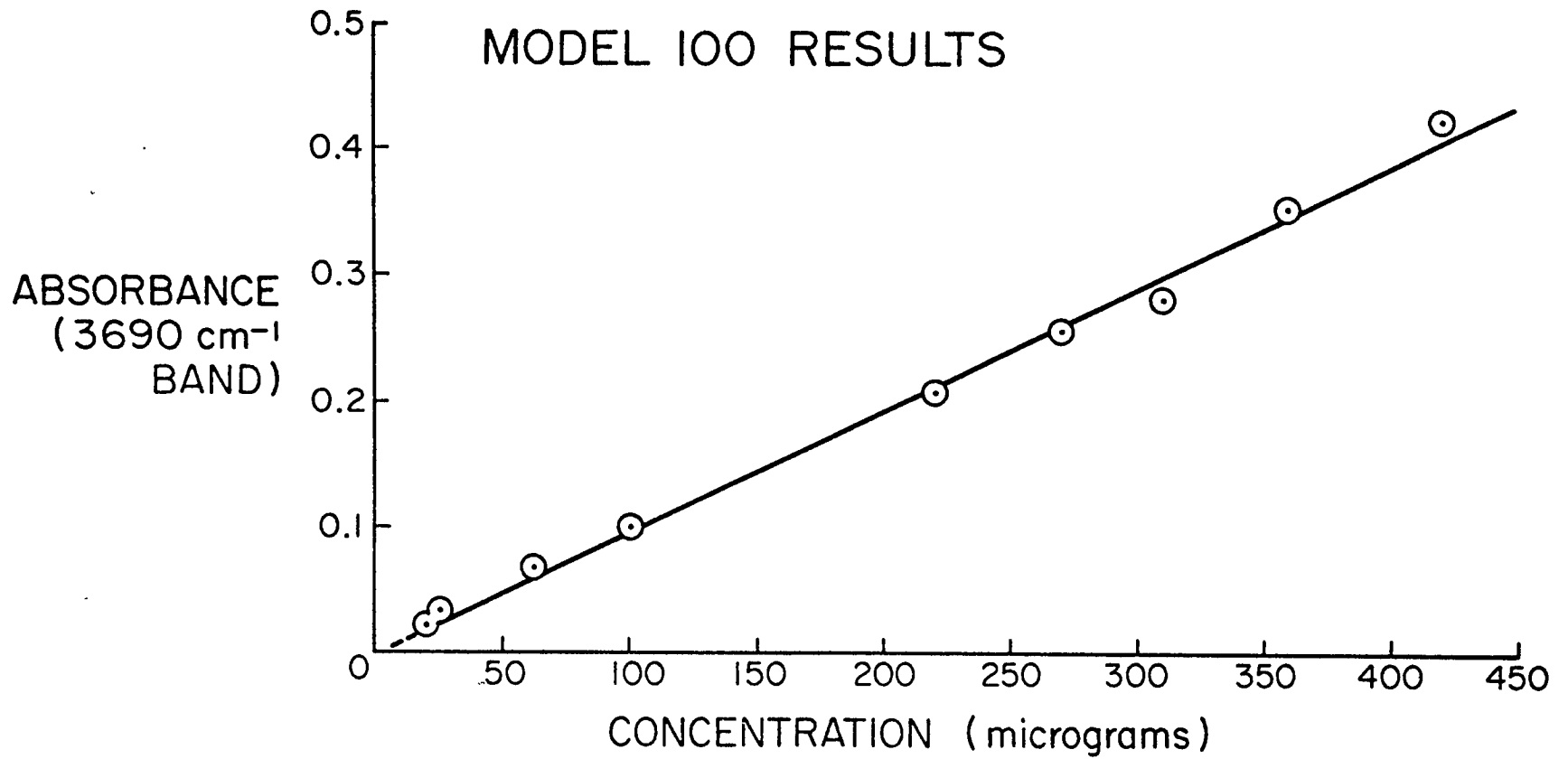
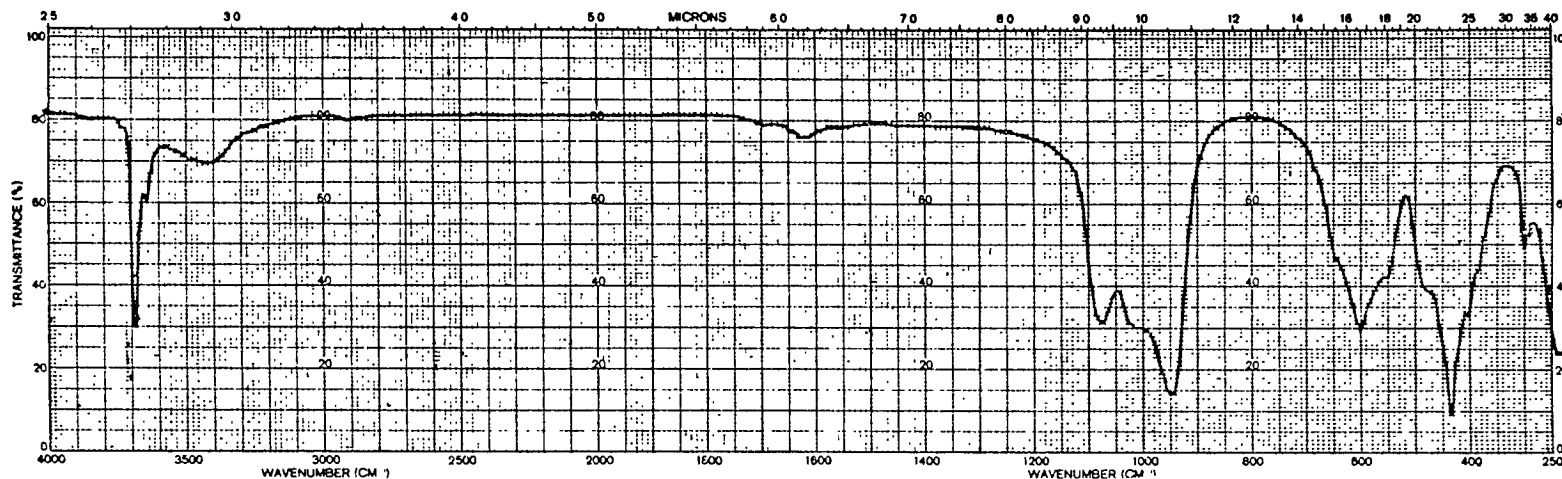


FIGURE 2

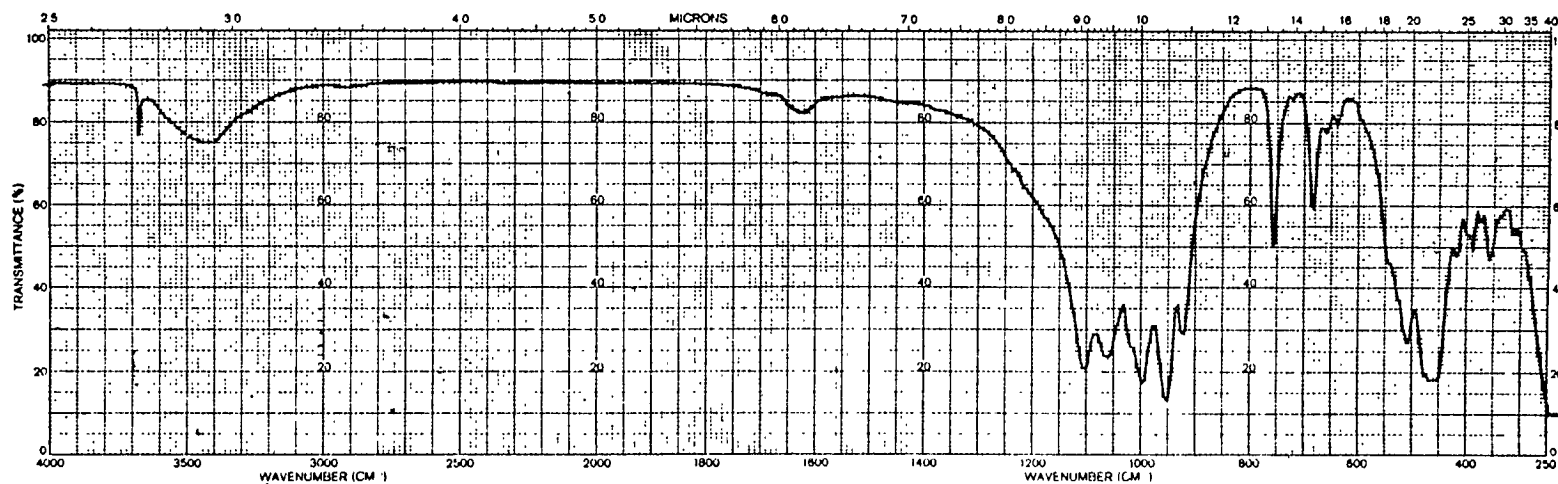
ASBESTOS (CHRYSTOLE FORM)

FIGURE 1a



ASBESTOS (MIXED FORMS)

FIGURE 1b



C. Calibration Curve:

After the band absorbance values are obtained for the standard pellets, a calibration curve is established by plotting the 3680 cm^{-1} absorbance versus the known chrysotile concentration in micrograms. After this curve has been prepared, a chrysotile sample of unknown concentration can be analyzed as a 13 mm KBr pellet, the O-H band absorbance measured, and the concentration determined from this working curve.

RESULTS:

In Figure 2, the calibration curve for the chrysotile standard pellets is shown. This plot is linear and can be used to determine an unknown concentration of airborne asbestos in a contaminated atmosphere.

The detection limit, based on the ability to measure the analytical band at a 2:1 or 3:1 peak height to noise ratio, is determined to be $10\text{ }\mu\text{g}$ of asbestos. This limit is easily obtained on the Model 467 using 5X ordinate expansion and a 13 mm KBr pellet. Attempts to utilize a micro-pellet (1.5 mm) of chrysotile in KBr to increase the detection limit were unsuccessful. At concentrations lower than $10\text{ }\mu\text{g}$, sample handling of the standard 13 mm pellets is extremely critical. Contamination from airborne asbestos in the laboratory is very probable and only special handling will permit one to use micro-pellets. At concentration lower than $10\text{ }\mu\text{g}$, the Beer-Lambert plot becomes non-linear, almost a horizontal line.

CONCLUSIONS:

The identification of the crystalline form of asbestos by infrared is extremely simple and fast. The major advantages of using infrared is that the method involves only a small sample, in the μg range. Once the identification has been assigned to chrysotile, a quantitative measure can be made. The Beer-Lambert plot of the O-H band absorbance versus the known concentration is linear. The detection limit is found to be $10\text{ }\mu\text{g}$ of chrysotile analyzed as a 13 mm KBr pellet.

This determination will be interfered with by micas, clays and other silicates with lattice hydroxyl groups which absorb around 3680 cm^{-1} . From a spectrum of the full range, $4000\text{-}250\text{ cm}^{-1}$, one can identify any materials other than chrysotile.

EQUIPMENT USED:

1. Model 467
2. KBr powder
3. KBr die
4. KBr disc holder
5. Model 100 Data Manipulator
6. Membrane filter
7. Low temperature asher

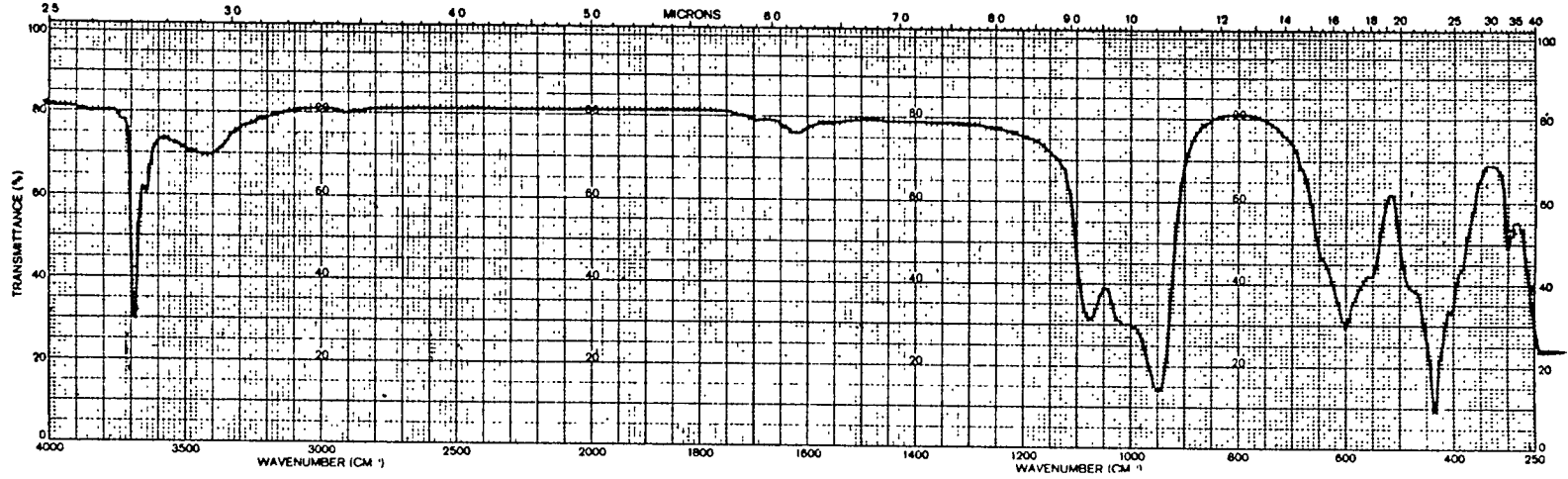
REFERENCES:

1. Asbestos, The Need for and Feasibility of Air Pollution Controls, ISBN 0-309-01927-3, National Academy of Sciences, Washington, D.C., 1971.
2. Goodhead, K., and R.W. Martindale, Analyst, 94 (985-88) 1969.
3. Gadsden, J.A., J. Parker, and W.L. Smith, Atmospheric Environment, Vol. 4, Pergamon Press, p. 6667-670, London, 1970.

7/25/73

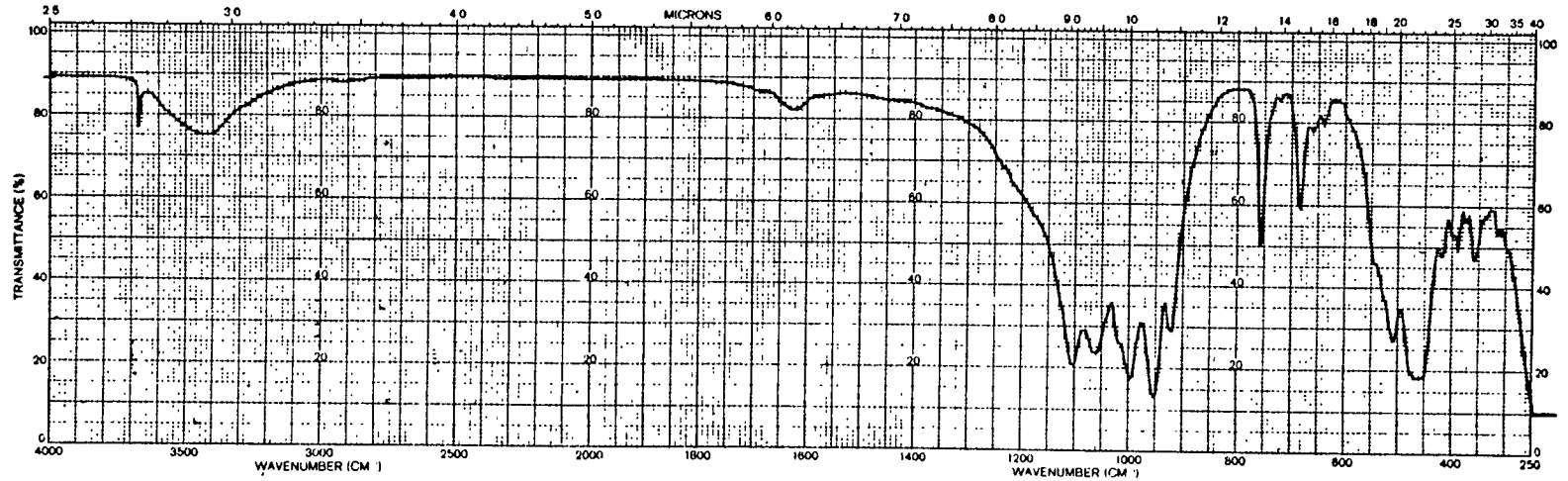
ASBESTOS (CHRYSTOLE FORM)

FIGURE 1a



ASBESTOS (MIXED FORMS)

FIGURE 1b



DETECTION LIMIT OF ASBESTOS

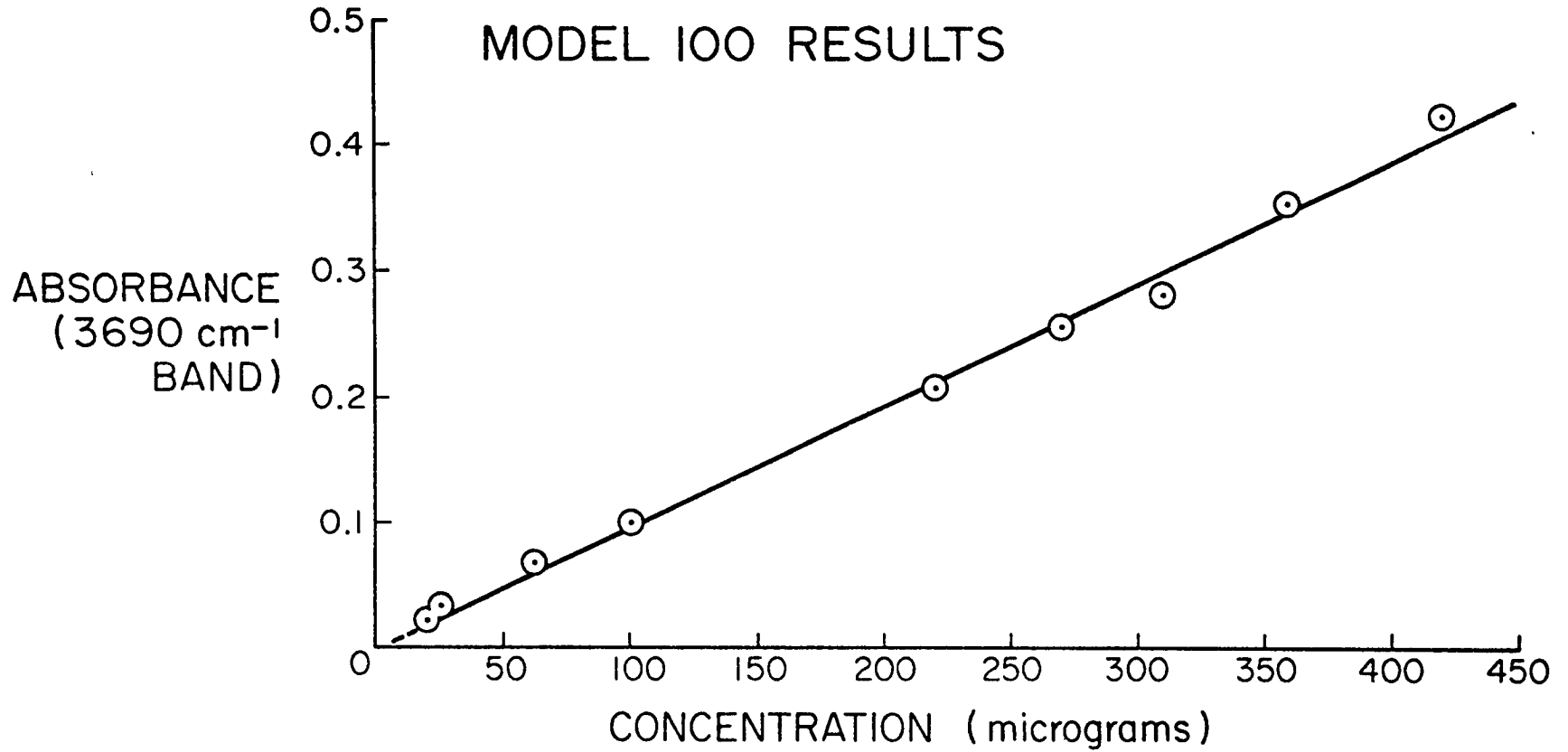


FIGURE 2

Talcs from England

ATN 22077

~~IR and~~ DTA analyses of the above seven talcs indicated no presence of chrysotile asbestos. IR indicated no presence of tremolite in 6 samples, but showed small amount (0.5-1.0%) in the Alabama talc ^{6.11.75} Code 07550.

This Alabama talc was sent out to McCrone ass for confirmation. Initially, they indicated that some tremolite was present, but it was non-fibrous. Later they said it was not tremolite but possibly antigorite (non fibrous serpentine). ~~The~~ Our IR analysis clearly shows that the Alabama talc contains (0.5 to 1.0%) tremolite. Since the asbestos in talc situation is still very much on the firing line, I would not recommend using this talc. ~~Some~~ of the Italian Talcs ^{CODE 0760} showed considerable amount of chlorite about 18%.

The two French talcs contained over 35% chlorite.

Ref 3412-35

WL

IR, DTA