

MATERIALS
ANALYTICAL
SERVICES

ANALYSIS OF ZONOLITE ATTIC INSULATION

Submitted to:

J. Conard Metcalf

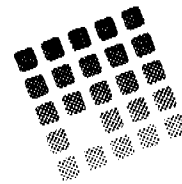
Williams & Trine

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MICROANALYSIS PROJECT REPORT

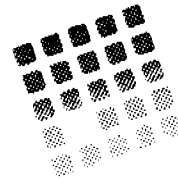
CLIENT: J. Conard Metcalf **DATE:** July 26, 1993
INSTITUTION: Williams & Trine, P.C. **PREPARATION BY:** Sean Fitzgerald
PROJECT: Zonolite Product Analysis **ANALYSIS BY:** Sean Fitzgerald
MAS NO.: M7099-1 **P.O. NUMBER:** N/A

SUMMARY: The objective of this study was to determine the presence or absence of tremolite/actinolite asbestos in Zonolite Attic Insulation that was manufactured by W.R. Grace.

DESCRIPTION: In August of 1991, Materials Analytical Services, Inc. (MAS) received one 12 pound bag labeled "Zonolite Attic Insulation, All Mineral Vermiculite", as a known reference material. In July of 1993, the Zonolite Attic Insulation was retrieved from the MAS archive storage room and analyzed by optical microscopy, scanning electron microscopy (SEM) and transmission electron microscopy (TEM).

PREPARATION AND ANALYSIS: After removing a random sample of the vermiculite for testing, the zonolite bag was photographed front and back as shown in figures 1 and 2. The Zonolite bag was essentially received in our laboratory in an unopened condition, but due to the deterioration of the plastic over time, the Zonolite bag fell apart during handling for the photography and had to be re-constructed. The remaining loose vermiculite material (figure 3), was placed in a large plastic specimen bag for storage. The removed sub-sample of vermiculite was inspected with an Olympus SZ Zoom Stereo Microscope at magnifications from 7X to 40X, as shown in figures 4 and 5. In one of the vermiculite pellets, a fibrous grayish mineral was observed associated with the vermiculite material as shown by the arrows in both figures 4 and 5. Samples of the vermiculite material were then prepared for both SEM and TEM.

The SEM preparation was performed by placing one of the vermiculite pellets containing the associated fibrous mineral onto a SEM stub with double-sided carbon tape and carbon paint. The sample was then carbon-coated in a Hitachi Vacuum Evaporator. The SEM analysis was performed using a Hitachi S-800 Field Emission SEM with a Tracor Northern EDXA system. The SEM photomicrographs shown in figures 6 through 11 further show the fibrous mineral intergrowth in between the vermiculite leaves for that particular sample. The EDXA spectra of the fibrous mineral was consistent with tremolite-actinolite (see figures 12 and 13).



The TEM preparation of the vermiculite sample was performed by suspending between 10 - 30 mg of the fine vermiculite dust fraction in reagent alcohol that was then filtered onto a 0.2 μ m polycarbonate (PC) filter. The filter was dried, carbon coated, and a section of the filter was placed on a 200 mesh TEM grid. The PC filter material was dissolved in a chloroform Jaffe washer and the final TEM prep was examined in a JEOL 1200 EX II TEM. The TEM photomicrographs in figures 14 and 16 show that the tremolite-actinolite structures found had an aspect ratio greater than 3:1, and therefore can be classified as an asbestiform structure as specified by current Federal regulations. A Tracor Northern system was used to obtain EDXA spectra, as shown in figure 18, and a selected area electron diffraction (SAED) pattern was recorded as shown in figure 17. The EDXA and SAED information was used to positively identify the fibrous mineral found in the vermiculite samples as asbestiform tremolite-actinolite.

DISCUSSION AND CONCLUSION

It is well known that in some areas of the country where vermiculite where vermiculite deposits are found, asbestiform tremolite-actinolite can also be found as an associated mineral. However, there has been some suggestion that during the processing of the vermiculite ore at the manufacturing plant, the asbestiform tremolite-actinolite is somehow removed and the final vermiculite product that is then sold to the consumer, is tremolite-actinolite free.

This study was designed to test that theory by taking a known sample of a processed vermiculite product (Zonolite Attic Insulation as manufactured by W.R. Grace), and determine if it contained asbestiform tremolite-actinolite.

Our analysis showed that there was tremolite-actinolite found in with the vermiculite in the Zonolite Attic Insulation product (figures 5 through 11). The tremolite-actinolite was found both associated with vermiculite and as free respirable fibers in the fine dust as shown in figures 14 through 16.

It is therefore our conclusion that the tremolite-actinolite does remain associated with the vermiculite after the ore is fully processed and can be found with the finished product, as demonstrated with the W.R. Grace Zonolite Attic Insulation.



FIGURE 1



FIGURE 3



FIGURE 4

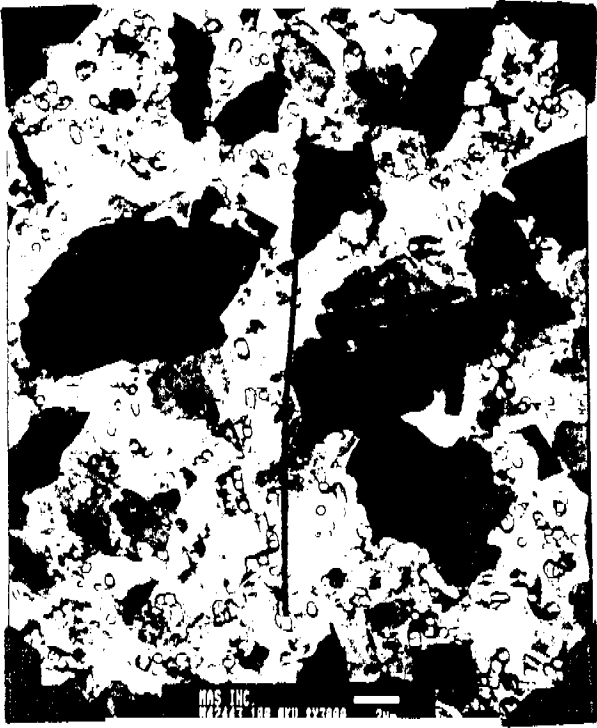


FIGURE 14



FIGURE 15



FIGURE 16



FIGURE 17



FIGURE 5 ↑



FIGURE 6



FIGURE 7 ↑



FIGURE 8



FIGURE 9

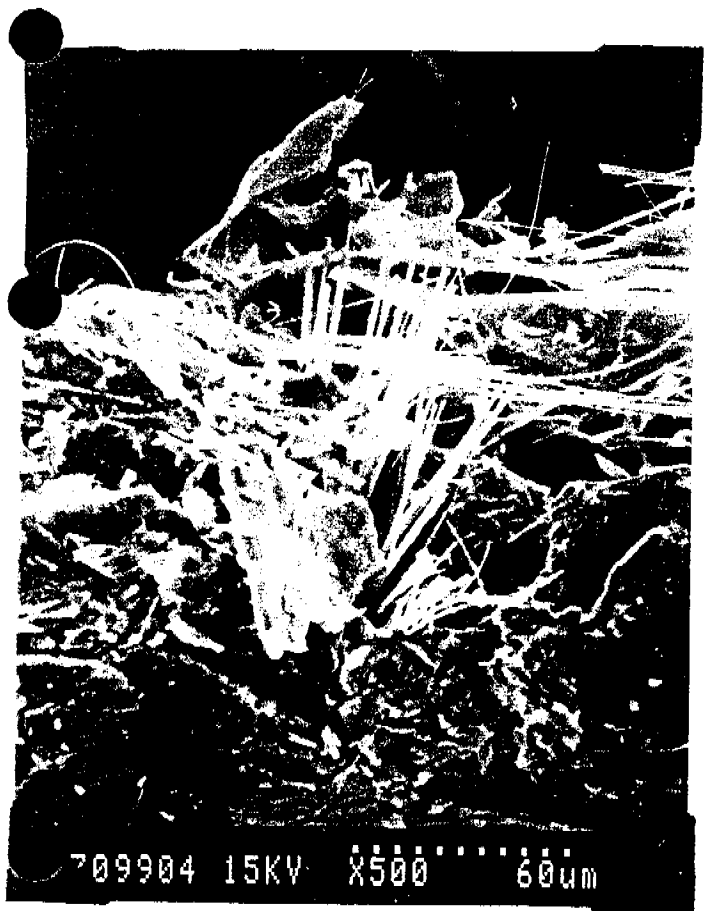


FIGURE 10



FIGURE 11



FIGURE 1

Insulation

"Do-it-yourself" and save money with the easy to install, all-weather vermiculite insulation that will not burn.

Vermiculite A-100 Insulation helps you seal off drafts, heating and cooling leaks resulting from gaps in existing insulation, crossbracing and ventilation pipes.

- Helps reduce heating and cooling costs
- Easy to install - just pour and level
- Will not burn - 100% mineral vermiculite
- Resists mold and mildew

1. POUR

Lightweight and easy to handle, Vermiculite A-100 Insulation can be poured over existing insulation or used alone. Remember to fill all gaps and crevices. Around trusses, rafters, etc., seal leaks and air leakage.



2. LEVEL

Simply level the vermiculite insulation with a straight edge and trowel. The insulation will settle and compact itself into a smooth, uniform surface.



To get the marked "R" value, it is essential that the board be installed properly. If you do it yourself, follow the instructions carefully. "R" means resistance to heat flow. The higher the "R" value, the greater the insulation power.

Savings vary. Find out why in the seller's literature on "R" value. It is the greater insulating power.

Thickness (Inches)	1	2	3	4	5	6
"R" Value	2.5	4.8	7.1	9.4	11.7	14.0
Coverage*	33	17	11	8	7	6
Weight (lb.)	8	16	24	32	40	48

*Coverage based on 100 sq. ft. of area to be insulated. Coverage may vary due to irregularities in joints or studs to which insulation is applied.

FIGURE 2



FIGURE 1

Insulation

"Do-it-yourself" and save money with the easy to install, all-mineral vermiculite insulation that will not burn.

Vermiculite A-100 insulation helps you seal off heat, heat, and cooling leaks resulting from gaps in existing insulation, crossbracing, and ventilation pipes.

- Heat loss - 1/2" thick - 50% saving costs
- Heat gain - 1/2" thick - 50% saving costs
- Fire - 1000° F. - 100% protection
- Resistance - 100% protection

1. POUR

Lightweight and easy to handle, Vermiculite A-100 insulation can be poured over existing insulation or used alone. Vermiculite fills gaps between pipes, around bracing, conduits, electrical boxes, and chimneys.

Roofing - Use dust to a minimum by using a vacuum or blower. Vermiculite A-100 insulation is available in 100 lb. bags.



2. LEVEL

Simply walk the vermiculite over the surface and level it. Vermiculite A-100 insulation is available in 100 lb. bags.



To get the marked "R" value, it is essential that the material be installed in the correct manner. If you do it yourself, follow the instructions carefully.

"R" means resistance to heat flow. The higher the "R" value, the greater the insulation power.

Savings vary. Find out why in the seller's literature on "R" value. Vermiculite A-100 insulation is available in 100 lb. bags.

Thickness (Inches)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
R Value	2.1	4.2	6.3	8.4	10.5	12.6	14.7	16.8	18.9	21.0	23.1	25.2	27.3	29.4	31.5	33.6	35.7	37.8	39.9	42.0
Coverage (sq. ft.)	33	17	11	8	6	5	4	3	3	2	2	1	1	1	1	1	1	1	1	1

See your dealer for more information on Vermiculite A-100 insulation.

Vermiculite A-100 insulation is available in 100 lb. bags. For more information, contact your local Vermiculite distributor.

FIGURE 2



FIGURE 3



FIGURE 4



FIGURE 5



FIGURE 6



FIGURE 7



FIGURE 8

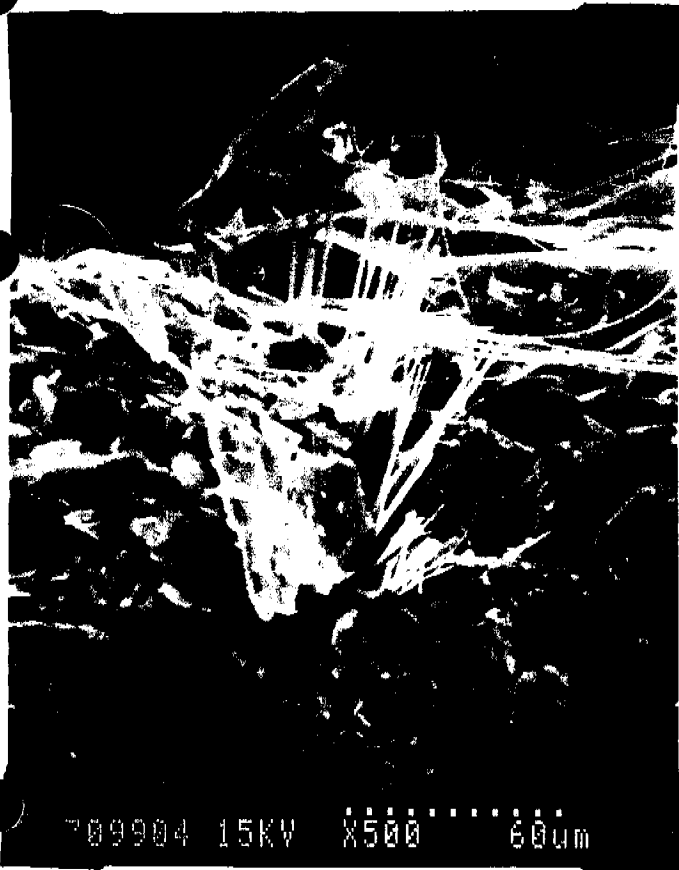


FIGURE 10



FIGURE 11

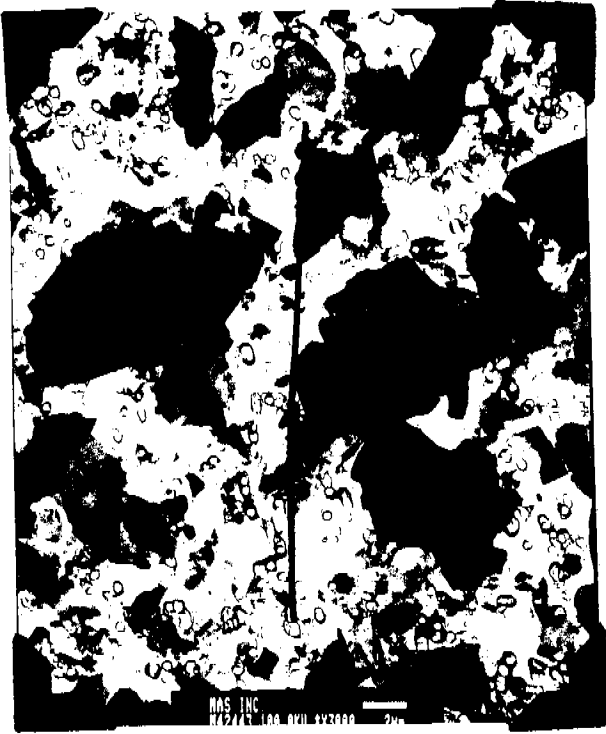


FIGURE 14



FIGURE 15



FIGURE 16

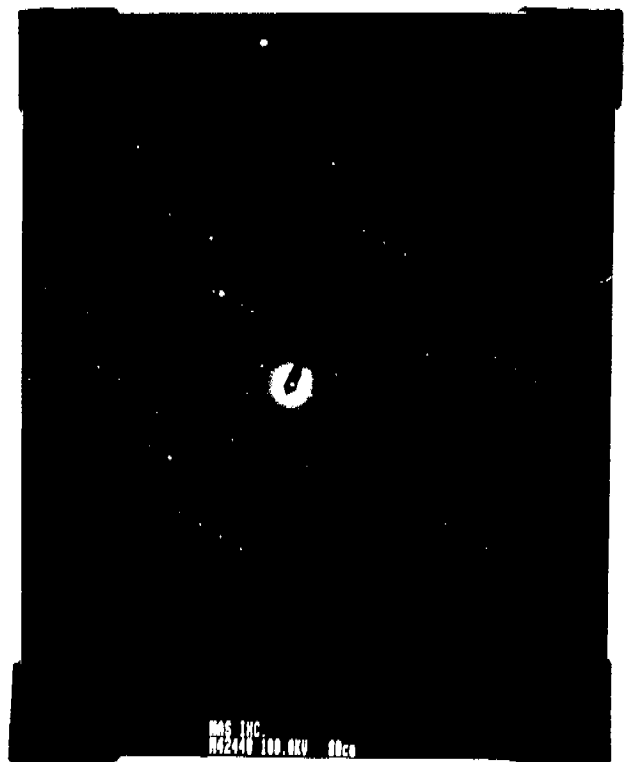


FIGURE 17