Heat or Otherwise Altered Asbestos

Background

Building materials that contain asbestos may at times be exposed to high temperatures or chemicals. Asbestos insulation samples applied to boilers, furnaces, steam pipes, etc., are exposed to very high temperatures for extended periods of time. All types of building materials may be exposed to very high temperatures in fires of all types (wildfires, building fires, etc.). This exposure can eventually alter the asbestos present, changing slightly or not so slightly, the crystal structure and chemical composition of the fibers. Other scenarios, such as exposure to acids, can also have similar effects on asbestos fibers, but by far, the most common example is the alteration of the asbestos by high temperatures.

Though amphiboles are common in these types of samples, it is typically chrysotile that shows the greatest degree of alteration, because it can be altered at a lower temperature as compared to most amphiboles. For chrysotile, the refractive index (RI) and Selected Area Electron Diffraction (SAED) are the most affected, since this relates to the fiber's crystal structure. The loss of SAED in chrysotile may be related to the more delicate nature of the chrysotile scrolled structure, where bonds between the scrolled structures may be more stressed and likely to break than in the more durable amphibole crystal. Amphiboles also will exhibit a change in Refractive Index (RI), but the SAED, as measured in TEM, is not typically affected. More extreme alteration is needed to have a significant effect on amphibole SAED. For all asbestos types, heating fibers will eventually cause their RIs to increase. Chemical alteration also effects RI, but instead of an increase, this normally lowers the refractive index.

Other notable changes observed by PLM include changes in the sign of elongation, fiber color, and morphology. Crocidolite changes its sign of elongation as well as its fiber color. Chrysotile and Amosite will also have a change in color. Additionally, most asbestos types become less flexible after heating. Asbestos bundles may appear "fused" together giving a blocky appearance. Crocidolite also is the first of these types to exhibit any change at all; a short duration at 375°C is enough to start causing these changes.

In TEM, when the chrysotile scroll looks to be damaged or fused with neighboring fibers, the SAED patterns for suspect chrysotile fibers may not be attainable and altered elemental ratios such as a lower-than-expected Mg-Si ratio may be observed.

EMSL's Policy

When we encounter a fiber(s) suspected to be altered asbestos because the identifying characteristics (RI, fiber color, sign of elongation, diffraction, EDXA) are outside the acceptable normal range:

For PLM:

EMSL will attempt to identify fibers or bundles that appear to be altered asbestos. Often bundles of the suspect fibers may be teased apart, leaving unaltered optical properties to be observed. When suspect material is deemed to be asbestos with normal optical properties, then the sample goes from "no asbestos detected" to at least "<1%."

EMSL will only consider the portion of the suspect asbestos fibers that possess correct optical properties to actually be asbestos for the purposes of final results. It is likely <1% asbestos will be reported in these situations.

Just because asbestos fibers with RI values are detected, does not mean they should be extrapolated to the entire sample of "abnormal" fibers. Regardless of whether the final result is non-detect or ≤ 1% or > 1%, it is very important to report both the portion of suspect altered asbestos as non-asbestos fiber on the reports, as well as placing a comment on the sample report, such as:

PLM: "Numerous fibers were found with optical properties outside the acceptable limits for regulated asbestos. These fibers are possibly altered asbestos fibers and were not included in the asbestos sample concentration."

For TEM:

The analyst may attribute the abnormal chemistry or diffraction to heat-altered asbestos, but without the observation of the "normal" properties, it still cannot be called asbestos. In the case of chrysotile, a spectra with a lower than expected Mg peak and absent or poor SAED, may be a non-asbestos fiber, such as sepiolite. Amphiboles are more likely to possess standard SAED diffraction and chemistry, so it is less likely you will need to make that call for them.

Like PLM, when trying to determine an estimated percent of altered asbestos in TEM, EMSL will only consider the portion of the suspected asbestos fibers that possess correct diffraction and/or chemistry to actually be deemed asbestos for the purposes of final results.

Just because some fibers with correct SAED and/or chemistry are detected, this does not mean the identification can be made to all similar fibers.

TEM: "Numerous fibers were found with diffraction patterns and/or chemical composition outside the acceptable limits normal range of regulated asbestos. These fibers are possibly altered asbestos and were not included in the asbestos sample concentration."

Question: Is heat altered or chemically treated asbestos still asbestos?

Answer: Whether the analysis is PLM or TEM, the methods give laboratories specific criteria to use to determine if a fiber is countable as asbestos. In order to report asbestos this criteria must be met, therefore altered asbestos fibers will not be included in the asbestos percentage even when it is believed outside circumstances, such as heat, may be the cause of the disparity.

It is also important to note that according to OSHA (and a number of its state counterparts), altered asbestos is considered to be asbestos, even if not considered countable asbestos by the method.

If you have any questions, or require additional information, please do not hesitate to contact us!
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