

On-Site Elemental Analysis of Drywall with the Thermo Scientific Niton XL3t Series XRF Analyzer



Application

Reports of headaches, nosebleeds, central nervous system disorders, and other serious health effects have been reported from those exposed to compounds emitted from Chinese drywall (CDW). Additionally, surface corrosion of metal objects, including jewelry, decorative plumbing fixtures, HVAC coils, and electrical wires have resulted in cosmetic and mechanical damages. These damages can include the failure of air conditioning systems, electronic equipment, and reports of fires¹ resulting from electrical short circuits. Starting with building material shortages in 2004 because of the housing boom in Florida and Houston, and exacerbated by rebuilding efforts starting in 2005 in response to hurricanes Katrina and Rita, more than 550 million pounds of drywall have been imported from China between 2004 and 2008. Clearly, demand exceeded the North American supply of this material.

With complaints from more than 20 states and the District of Columbia, the U.S. Environmental Protection Agency (EPA), supporting the Consumer Product Safety Commission (CPSC), began to analyze samples of drywall imported from China. Their investigation² included an elemental analysis of CDW, comparing it with samples of drywall manufactured in the United States. The results showed that elemental differences between the samples were clearly identifiable. The technology they used to make this determination? A Thermo Scientific Niton x-ray fluorescence (XRF) analyzer.

This versatile analyzer is the tool and method of choice for home inspection as well as elemental analysis of minerals. It has been used for many years for U.S. Housing and Urban Development (HUD) screening of lead (Pb) in paint. Similarly, this analyzer has also been used successfully for determining the elemental composition of gypsum in the cement process where gypsum is added during the course of making Portland

cement. It follows then that the elemental analysis of gypsum in the home is an appropriate and fitting application for our XRF instrument.

Method

For the purpose of direct comparison of handheld XRF results with laboratory data, three certified gypsum standards were measured using a Niton[®] XL3t in Mining Mode. Samples were placed in standard 32 mm XRF sample cups, covered with mylar film, and analyzed for a total of 210 seconds (30 s main, 30 s low, 30 s high, 120 s light). Analysis time and filter requirement depends on analysis goals. For rapid screening, an analysis of 30 seconds or less may be acceptable. An additional set of measurements was performed as follows: cupped samples were covered with a single sheet of drywall paper and analyzed to determine how quickly the three samples could be sorted based on their elemental concentrations. The measurement was repeated again, replacing the sheet of drywall paper with a sheet of painted drywall paper (single coat of latex paint over primer).



Thermo Scientific Niton XRF analyzers are ideal for the elemental analysis of drywall.

Additional measurements were performed using the Niton XL3t in Metal Alloy Mode to determine the analyzer's ability to identify sulfur (S) attack on copper (Cu) surfaces. Measurement times of 30 seconds were performed on bare copper pipe, as well as copper pipe removed from a Florida home that was identified as containing CDW.

Results

Table 1 shows the results obtained using the Niton XL3t 900S handheld XRF analyzer as compared with the certified values for three certified gypsum samples.

CCRM *	Niton XL3t	CCRM
Sample	% CaO	% CaO cert
FGD-1	32.2	32.7
FGD-2	32.6	32.8
TIG-1	32.9	32.3
Sample	% SO ₃	% SO ₃ cert
FGD-1	45.4	46.4
FGD-2	45.3	45.6
TIG-1	44.7	43.4
Sample	% SrO	% SrO cert
FGD-1	0.013	0.012
FGD-2	0.022	0.024
TIG-1	0.409	0.420

*Canadian Certified Reference Material

Table 1. Niton XL3t analyzer results compared with certified gypsum samples

Analytical methods used by participating laboratories to verify elemental concentrations included XRF, atomic absorption spectrophotometry (AAS), inductively coupled plasma emission (ICP), thermal

analysis (DTA-TGA), and neuron activation analysis (INAA). Figure 1 illustrates a comparison of the x-ray spectrum from the three samples.

The additional measurements performed with the Niton XL3t to identify sulfur attack showed conclusive separation of the two samples, using 30 s measurements on each sample. Investigators are comparing the values of the sulfur content of Cu pipes outside the home with the values of the sulfur content of Cu pipes inside the home. A significant difference is noted when defective drywall is present.

Comments

There are potentially over 1 million homes in the United States containing CDW, leading to a potential testing market of 5 to 10 million homes. Builders, homeowners, insurers, public health professionals, regulators, and even litigators need fast, reliable tools they can depend on to rapidly identify homes and offices containing this potentially toxic hazard. With the proven ability to quickly sort drywall based on elemental concentrations, handheld Thermo Scientific Niton XRF analyzers distinguish themselves as valuable tools that can quickly identify individual drywall sheets that meet the elemental profile of CDW. Now, those impacted by this contamination risk have the ability to survey an entire home, without damaging or disturbing any of the drywall, and record this information in a tamperproof format on a sheet-by-sheet basis for legal reporting.

To discuss your particular applications and performance requirements, or to schedule an on-site demonstration and see for yourself how our XRF analyzers can help save you time and money, please contact your local Thermo Scientific Niton Analyzer representative or contact us directly by email at niton@thermofisher.com, or visit our website at www.thermo.com/niton.

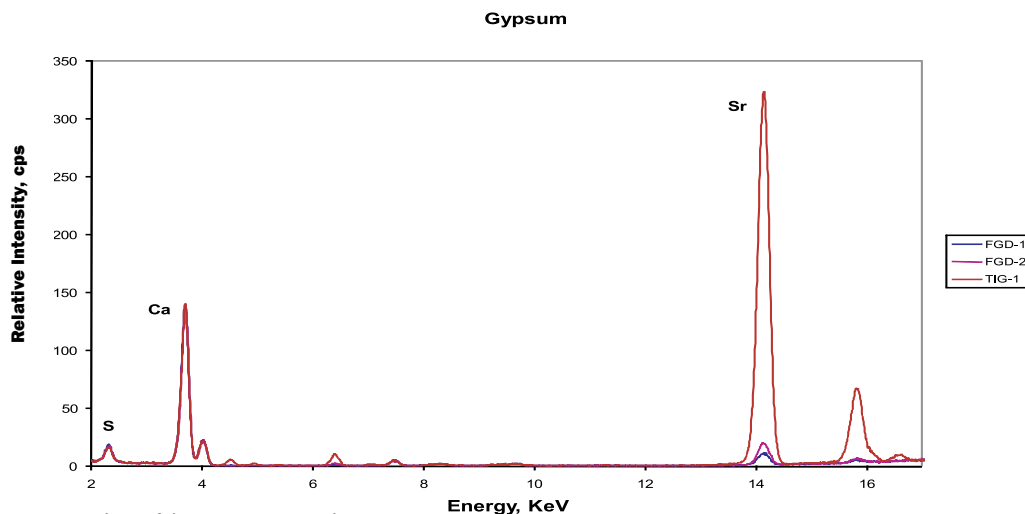


Figure 1. Spectra comparison of three gypsum samples

¹Kessler, Aaron, "Chinese drywall report mentions 'fire incidents'," *HeraldTribune.com*, July 8, 2009

²Environmental Protection Agency, *EPA Drywall Sampling Analysis*, May 7, 2009.

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