

APD2000 PRO

Asbestos: Calibration curves determination with the Silver Filter method.



Introduction

Asbestos is a set of naturally occurring silicate materials (inosilicates and phyllosilicates), among which the most commercially common forms are Amosite, Chrysotile and Crocidolite. In the past, its fibrous structure, low thermal conductivity and heat resistance were appealing for several applications, resulting in its widespread use.

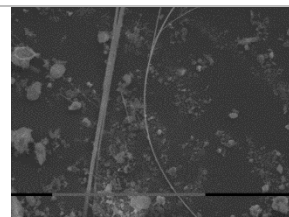
Nowadays, it is banned for its toxicity, when airborne.

Asbestos powder amount can be quantified mainly by three analytical techniques: X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FTIR).

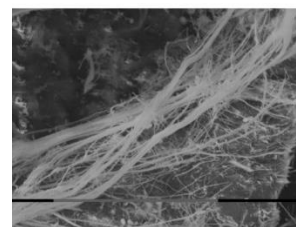
XRD with Silver Filter method is the most suitable technique for weight determination, being capable of detecting the different forms of asbestos with concentrations greater than 0.5-1% by weight¹.

Unknown sample quantification is performed by means of calibration curves, which allow to determine the asbestos form concentration through its XRD reference analytical peak area. The Limit of Detection (LOD) depends on both instrumental parameters and specimens.

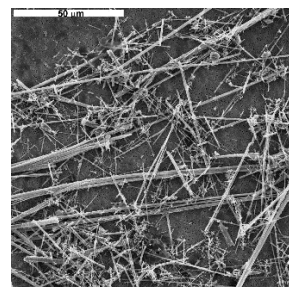
This note reports calibration curves for Amosite, Chrysotile and Crocidolite standards supplied by UICC (*Union Internationale Contre le Cancer*).



Amosite $(\text{FeMg})_7\text{Si}_8\text{O}_{22}(\text{OH})_2$



Chrysotile $\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$



Crocidolite $\text{Na}_2\text{Fe}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$

SEM images from our partner lab *Analitica S.A.S.*, <http://www.analitica-lab.it/lang1/>

Summary

X-Ray Diffraction with Silver filter method is one of the recommended techniques for determining the weight concentration of asbestos by means of calibration curves¹. GNR APD 2000 PRO, equipped with spinner and secondary monochromator, has proven its effectiveness in building these calibration curves for Amosite, Chrysotile and Crocidolite asbestos forms.

¹ DM 6-9-1994 allegato 1A; NIOSH 9000

Product Specifications

APD 2000 PRO is a θ - 2θ powder diffractometer equipped with a large choice of accessories, which make it versatile to cope with various requirements of an academic or industrial laboratory for pharmaceutical, mineral and environmental analysis.



Sample Preparation

Amosite, Chrysotile and Crocidolite samples from UICC were prepared and measured according to Italian DM 6.9.1994 Allegato 1A (*Metodo del filtro d'argento-Silver filter Method*) by GNR partner laboratory *Analitica S.A.S.*

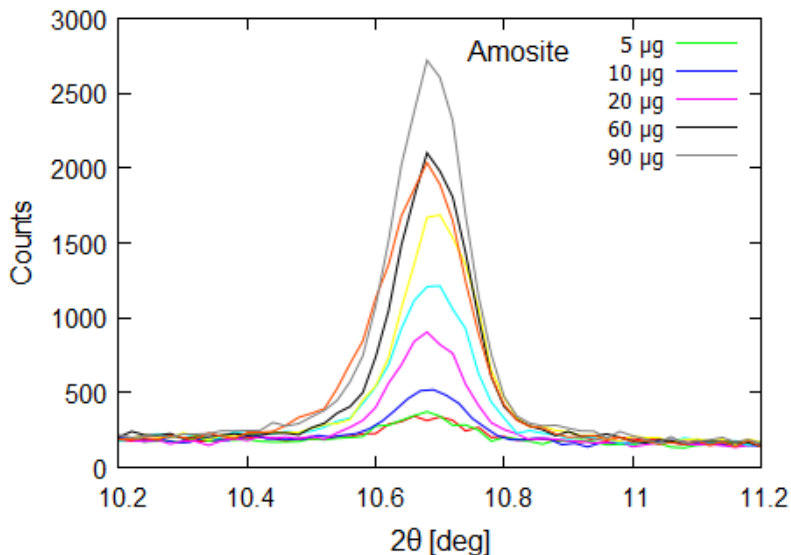
	<i>Amosite</i>	<i>Chrysotile</i>	<i>Crocidolite</i>
Goniometer radius [mm]		175	
X-Ray Source:		Cu	
Power [kV; mA]:		40;45	
Divergence slit[°]:		1	
Anti-scatter slit[°]:		1	
Soller slit (x 2) [°]:		2.3	
Receiving slit [mm]:		0.3	
Spinner [rpm]:		60	
Secondary monochromator		Graphite	
Detector:		Point scintillation detector	
Step[°]:		0.02	
Time/step[s]	5	10	5

Results

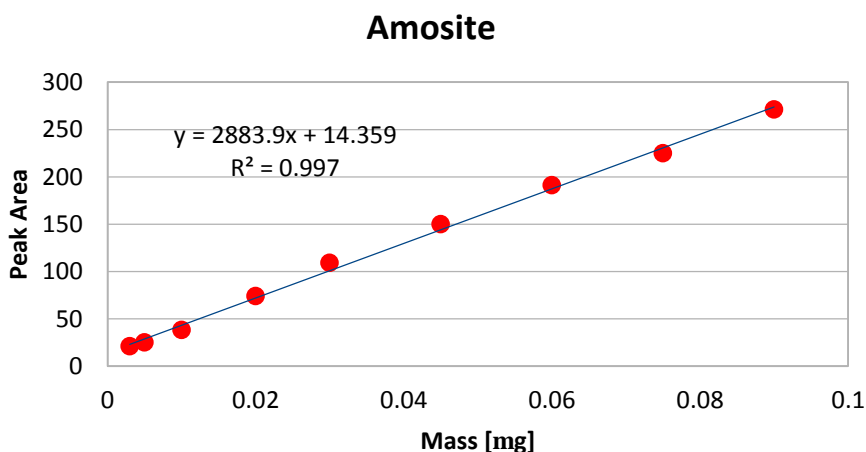
By way of illustration, reference peak of amosite (110) for different amounts of standard is reported on the right: from 3 to 90 µg (not all listed for clarity).

Similar results at different angular values are obtained for Chrysotile and Crocidolite.

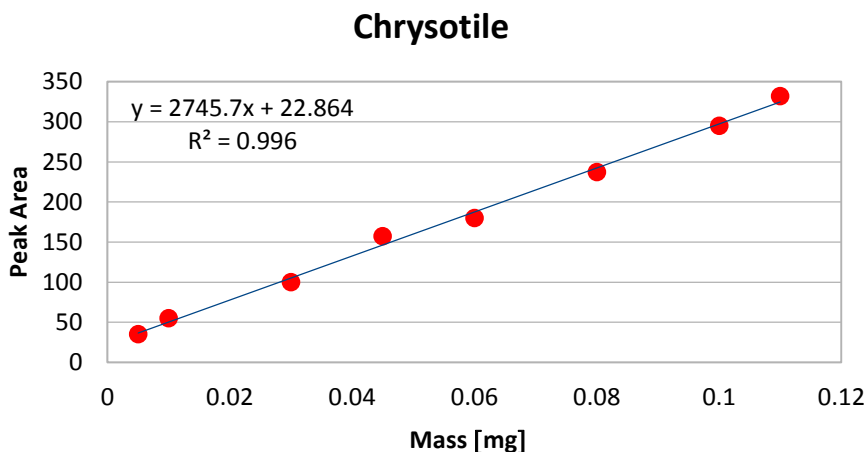
Calibration curves with resulting detection limit (LOD) are reported below.



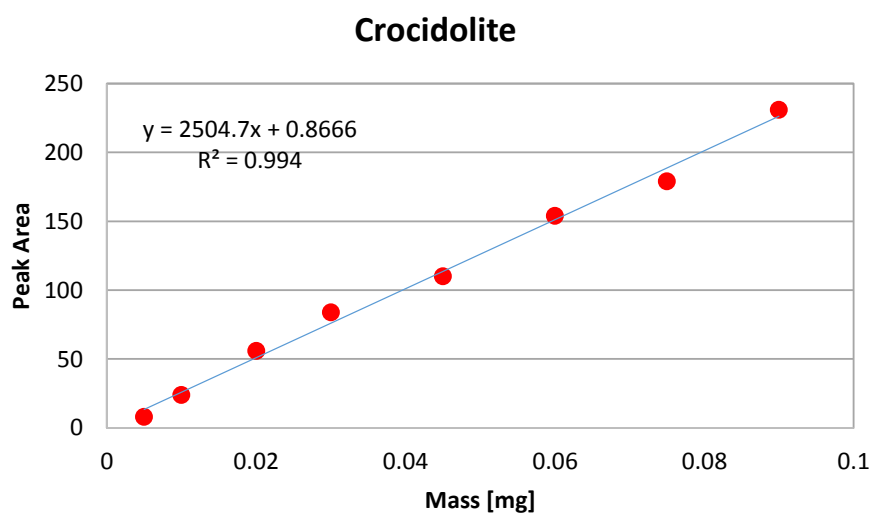
(LOD)= 0.004 mg
(4 µg)



(LOD)= 0.006 mg
(6 µg)



(LOD)= 0.005 mg
(5 µg)



Conclusions

Calibration curves, required for asbestos weight % determination, were built by means of Silver Filter method and APD2000 PRO, equipped with spinner and secondary monochromator. Resulting Limits of Detection are compliant with current normative.