

Tips for Identifying Anthophyllite, Tremolite and Actinolite in Bulk Asbestos Samples

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24% of NVLAP Labs Failed to Correctly Identify Anthophyllite in Proficiency Testing M11994

Of 408 participating laboratories:

- 10 did not report any asbestos (wollastonite?)
- 78 reported an asbestos other than anthophyllite
- 115 reported and/or outside the acceptable range

17% of NVLAP Labs Failed to Correctly Identify Actinolite/Tremolite in Proficiency Testing M21994

Of 397 participating laboratories:

- 10 did not report any asbestos (wollastonite?)
- 32 reported both actinolite and tremolite
- 24 reported an asbestos other than actinolite or tremolite (anthophyllite, amosite?)
- 119 reported α and/or γ outside the acceptable range

Diagnostic Properties of Tremolite/Actinolite and Anthophyllite (the So-Called "1.605 Amphiboles)

- Morphology: acicular or needle-like
- Color/pleochroism: colorless or slightly pleochroic
- Refractive indices and DS color in 1.625 HD liquid
 - 1.600 - 1.615 Very pale blue to blue
 - 1.630 - 1.640 Orange to yellow
- Extinction: Parallel or oblique (ext. angle $< 20^\circ$)
- Elongation: ALWAYS positive

Distinguishing Anthophyllite from Tremolite/Actinolite

Extinction behavior is the only criterion

- Make sure that PLM is properly aligned:
 - the ocular cross hairs are parallel to the privileged directions of polarizer and analyzer
- Examine the extinction position of at least 30 fibers
 - Anthophyllite
all fibers show parallel extinction
 - Tremolite/Actinolite
some fibers show parallel extinction and
some fibers show oblique extinction

Distinguishing Tremolite from Actinolite

- It is not always possible to distinguish between these two monoclinic amphiboles solely based on optical properties such as refractive indices and extinction angle
- For NVLAP Proficiency Testing, it is acceptable
 - to identify an actinolite to be tremolite or
 - to identify a tremolite to be actinolite

Properties of Anthophyllite, Tremolite, and Actinolite

Property	Anthophyllite	Tremolite	Actinolite
Crystallographic System	Orthorhombic	Monoclinic	Monoclinic
	1.588 - 1.650	1.600 - 1.620	1.620 - 1.670
	1.602 - 1.660	1.612 - 1.630	1.630 - 1.675
	1.613 - 1.670	1.625 - 1.645	1.645 - 1.688
Birefringence (-)	0.025 - 0.020	0.027 - 0.022	0.022 - 0.017
Extinction Angle*	0	21 - 15	18 - 13
Extinction Characteristics	Parallel	Parallel	
Extinction behavior	Parallel	Parallel or oblique	
References	Deer, Howie, and Zussman (1993) W. C. McCrone (1987)		