

ISO 14966:2019-12 (E)

Ambient air - Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Abbreviated terms	4
5	Principle	4
6	Apparatus and materials	4
6.1	Air sampling	4
6.1.1	Sampling head	4
6.1.2	Sampling train	5
6.1.3	Sampling pump	5
6.1.4	Needle valve	6
6.1.5	Volumetric flowmeter (rotameter)	6
6.1.6	Timer	6
6.1.7	Dry type gas meter (optional)	6
6.1.8	Meteorological instruments (optional)	6
6.1.9	Instruments for unattended sampling (optional)	7
6.2	Preparation of filters	7
6.2.1	Vacuum evaporator	7
6.2.2	Plasma asher	8
6.3	Sample analysis	8
6.3.1	Scanning electron microscope (SEM)	8
6.3.2	Energy-dispersive X-ray system	8
6.3.3	Stereo-microscope	9
6.3.4	Gold-coated capillary-pore polycarbonate filters	9
6.3.5	Backing filters	9
6.3.6	Disposable plastic field monitors (optional)	9
6.3.7	Technically pure oxygen	9
6.3.8	Rubber connecting hoses	9
6.3.9	Filter containers	9
6.3.10	Routine electron microscopy tools and supplies	9
6.3.11	Sample for resolution adjustment	9
6.3.12	Sample for magnification calibration	10
7	Air sample collection and analysis	10
7.1	Measurement planning	10
7.2	Collection of air samples	10
7.3	SEM specimen preparation	13
7.4	Analysis in the scanning electron microscope	13
7.4.1	General instructions	13
7.4.2	Fibre-counting criteria	14
7.4.3	Fibre classification	19
7.4.4	Analysis using reference spectra and peak height ratios	26

7.4.5	Measurement of fibre dimensions	28
7.4.6	Recording of data on the fibre counting form	28
8	Calculation of results	28
8.1	Calculation of the mean fibre concentration	28
8.2	Calculation of the 95 % confidence interval	30
9	Performance characteristics	30
9.1	General	30
9.2	Measurement uncertainty	30
9.2.1	Systematic errors	30
9.2.2	Random errors	30
9.2.3	Errors due to sampling	31
9.2.4	Errors associated with the SEM examination	31
9.2.5	Total error of the measurement	31
9.2.6	Random errors due to fibre counting	32
9.3	Limit of detection	34
10	Test report	35
	Annex A (normative) Preparation of filters for air sampling	37
	Annex B (normative) Procedures for calibration and adjustment of the SEM	38
	Annex C (informative) Characteristics and chemical composition of inorganic fibres	40
	Annex D (informative) Poisson variability as a function of fibre density on sampling filter and area of filter analysed	45
	Annex E (informative) Combination of the results from multiple samples	47
	Bibliography	48