



NEX CG II⁺



- **Model**
NEX CG II+
- **X-ray tube**
65 kV 100 W Pd-anode
- **Excitation**
Indirect with polarization EDXRF
- **Detector**
Large-area SDD
- **Autosampler**
32 mm, 40 mm, 50 mm tray options
- **Sample type**
Nuclepore® Air Filters
- **Analysis Time**
Variable
- **Atmosphere**
Helium

SCOPE

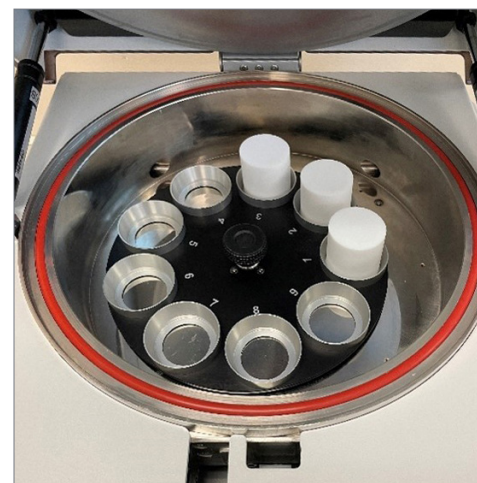
The analysis of air filters in compliance with instrument sensitivity as outlined by U.S. EPA method IO-3.3 (1999) is demonstrated using NEX CG II+ EDXRF analyzer.

BACKGROUND

In the 1970s, the United States created the Clean Air Act, setting standards to regulate emissions of pollutants that "endanger public health and welfare" with oversight by the U.S. Environmental Protection Agency (EPA). In the late 1990s, the EPA issued method IO-3.3 detailing the sensitivity required by EDXRF analyzers for measuring the elemental composition of air filters. To meet these testing requirements, Rigaku offers NEX CG II+, a 100 W indirect excitation EDXRF system using secondary targets and polarization in full 90° Cartesian Geometry for superior sensitivity and analysis of elemental particulate matter on air filters.

SAMPLE PREPARATION

Air filter samples are measured directly, deposited side down facing the X-ray beam. A special cup is placed over the sample to provide consistent results. The large analysis chamber offers single position measurement or automatic sample changers. Options for autosampler trays include 15-position 32 mm, 10-position 40 mm, or 9-position 52 mm for 47 mm up to 50 mm diameter filters.



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U.S. EPA METHOD IO-3.3 SENSITIVITY COMPLIANCE

Sensitivity compliance is demonstrated using Nuclepore® filters and empirical calibration using single element standards. Detection limits are reported as 1σ as per EPA IO-3.3. Measurement times can be adjusted for particular subsets of elements of interest or to meet requirements for different filter materials such as Teflon®.

Element	Line	EPA IO-3.3 1σ MDL (ng/cm ²)	NEX CG II+ 1σ LLD (ng/cm ²)	Measurement Time	Secondary Target
Na	Kα	17.4	3.6	200 sec	RX9 Polarizer
Mg	Kα	7.9	4.2		
Al	Kα	46.7	1.8	50 sec	
Si	Kα	21.2	0.6		
P	Kα	4.1	0.3		
S	Kα	6.9	0.3		
Cl	Kα	5.6	0.2		
Y	La	1.1	0.3		
Zr	La	1.1	0.4		
Mo	La	1.5	0.8		
Rh	La	26.5	6.4	250 sec	Cu Target
Pd	La	18.7	5.4		
Ag	La	20.3	8.6		
Cd	La	19.2	5.0		
Sn	La	31.5	4.0		
Sb	La	26.7	4.2		
Te	La	27.6	2.4		
I	La	34.4	2.6		
Cs	La	50.9	2.0		
Ba	La	58.3	1.8		
La	La	68.9	1.4		
K	Kα	5.6	2.2		
Ca	Kα	8.7	1.8		
Sc	Kα	1.3	1.2		
Ti	Kα	18.7	0.8		
V	Kα	5.5	0.6		
Cr	Kα	3.0	0.4		
Mn	Kα	0.8	0.4		
Fe	Kα	1.0	0.4		
Co	Kα	0.4	0.3		
Ni	Kα	0.7	0.7	3000 sec	Mo Target
Cu	Kα	0.8	0.8		
Zn	Kα	1.1	0.5	1000 sec	
Ga	Kα	1.5	1.3		
Ge	Kα	1.0	0.3		
As	Kα	0.9	0.5		
Se	Kα	0.6	0.3		
Br	Kα	0.7	0.4		
Rb	Kα	0.7	0.4		
Sr	Kα	0.9	0.6		
W	La	3.3	1.0		
Au	La	1.5	0.7		
Hg	La	1.5	1.0		
Pb	La	1.4	1.0		

Teflon is a registered trademark of E.I. du Pont de Nemours and Company and its affiliates.

DISCUSSION

The detection limit table shows NEX CG II+ meets the EPA sensitivity requirements for EDXRF analyzers. Actual air filter samples being tested will contain several elements rather than one element per filter. The subset of elements to be tested depends on each testing site's needs, for example, testing urban or rural air, air in an industrial area, or other specific sites to be tested. Typically, air filter samples being tested will have multiple elements in the loading at levels in the $\mu\text{g}/\text{cm}^2$ ranges.

When using NEX CG II+, the air filters are measured using Rigaku RPF-SQX Fundamental Parameters for excellent semi-quant concentration results and can be made fully quantitative, optimizing accuracy using the Matching Library section of RPF-SQX.

The operator can easily build a specific Matching Library for the elements of interest by measuring only one multi-element air filter sample with certified loading values. In this way, the Matching Library tunes the analyzer to the type of filter being tested and the certified referee values.

The QuantEZ® Filter template automatically compensates for different filter material, and measurement times can be adjusted for the subsets of elements being tested to optimize daily sample throughput.

CONCLUSION

The Rigaku NEX CG II+ combines Cartesian Geometry indirect excitation with secondary targets, polarization targets, and a high-performance large-area SDD detector to yield the optimum performance for the analysis of air filters. NEX CG II+ can be used to comply with EPA IO-3.3 sensitivity requirements. The NEX QuantEZ® software is simple to use yet powerful, making NEX CG II+ an excellent tool for non-technical operators and researchers alike.