ASOMA® PHOENIX II

Determination of Si Coatings on Paper and Clay-coated Paper

ASOMA® Phoenix II

All samples were analyzed using the PHOENIX II XRF Benchtop system. This report demonstrates the capability of the PHOENIX II to analyze silicon coatings on paper and clay-coated paper.

Silicone coating, measured as silicon (Si), is used as a release coating on paper. The Si coating on clay-coated paper is used for proper retention and quality of ink and pigments when printing on paper, such as paper for computer printers, fax machines, and thicker paper and cardboards used for the packaging of foods and other products.

Proper monitoring of coat weight is important. Over coating may cause loss of quality and undue over expense. Undercoating causes loss of quality. ASOMA® coating measurements require little sample preparation. Simply cut a sample coupon, place it in the sample chamber and analyze. Both of these benefits work together to maximize quality and reduce operational costs.

Introduction

The PHOENIX II is an excellent benchtop XRF analyzer for at-line production QC analysis or the laboratory alike. The PHOENIX II offers a fast, precise, simple and non-destructive analysis technique well suited for the determination of Si coatings on paper and clay-coated paper.

The PHOENIX II employs state-of-the-art optics. Polarization excitation offers unique benefits because it eliminates most of the background scatter emerging from the X-ray tube before it arrives at the sample. This results in a dramatic improvement in peak-to-background signal, especially in highly scattering materials such as petrochemical products. This translates to vastly improved precision and lower detection limits than traditional direct excitation XRF systems can achieve.

The PHOENIX II uses an onboard PC computer with a simple touch screen interface. Thus, an external computer is not required. Data handling and results storage can be obtained on a thermal paper print out and are also stored in the hard drive of the PHOENIX II. The data can be readily transferred to a USB thumb-drive or a network Ethernet connection.

Calibrations are readily carried out using assayed standards. This ensures easy traceability of results for quality purposes. This initial calibration process is a “once only” procedure. Subsequently, the curve can be restandardized, if required, by the touch of a button on the main analysis screen.

The PHOENIX II offers power, versatility and performance all in a small, compact, easy-to-use design.

Experimental Portion

Equipment

All measurements were conducted using a PHOENIX II XRF analyzer. Performance is shown for using a measurement time of 300 seconds for the paper applications, and 200 seconds for the clay-coated paper. Filters are used for the clay-coated paper, 200 seconds per filter, for a total analysis time of 400 seconds.

Sample Preparation

Simply cut a 5X5 inch square sample coupon and place it coating side down over the aperture in the sample chamber.

Measurement Parameters

All measurement parameters are easily controlled through the touch screen on the display panel. Operators simply choose the correct method from the analysis screen (there may be more than one method stored, e.g. to deal with paper or clay-coated paper) and then press the green ANALYZE button.

The results can be reported using a variety of different options: results are reported on the display screen; on a thermal paper printout; on an optional external printer; and in the database history within the analyzer.

Instrument Configuration

ASOMA® PHOENIX II

Excitation: 48 kV 50 W Air-cooled X-ray Tube
Detection: Gas-filled Proportional Counter
Analyte Optimization: X-ray voltage, current and X-ray filters
Atmosphere: Air
Options: HOPG crystal for polarized X-rays; Detector filter, Polypropylene 4 µm film
Note: No helium purge is required.

Typical paper sample shown in analysis position

Handy Conversion Factors

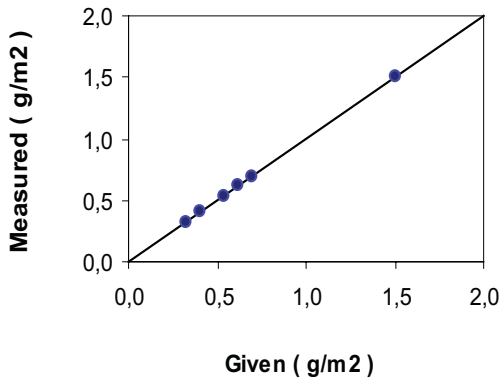
1 g/m² = 0.6132 lb/ream
1 mg/m² = 0.001 g/m²

Results for the Si on Paper (High Range)

Calibration for Si on Paper (High Range)

Element: Si	Std. Error of Estimate: 0.0066	
Units: g/m²	R.M.S.: 0.0019	
Sample	**Given**	**Measured**
1	1.50	1.501
2	0.70	0.696
3	0.62	0.628
4	0.54	0.534
5	0.41	0.411
6	0.33	0.325

Correlation Plot



Precision for Si on Paper (High Range)

10 repeat analyses at 300 seconds per measurement

Element: Si		Units: g/m²		
Sample	**Given**	**Mean**	**Std. Dev.**	**% Rel.**
1	1.50	1.503	0.003	0.2
6	0.33	0.329	0.001	0.3

Minimum Detection Limit (MDL)
Si on Paper (High Range)

The Minimum Detection Limit (MDL) for an element is determined as three times the standard deviation of ten analyses of the blank sample. The following MDL was derived using this empirical method and applies to this matrix and concentration range.

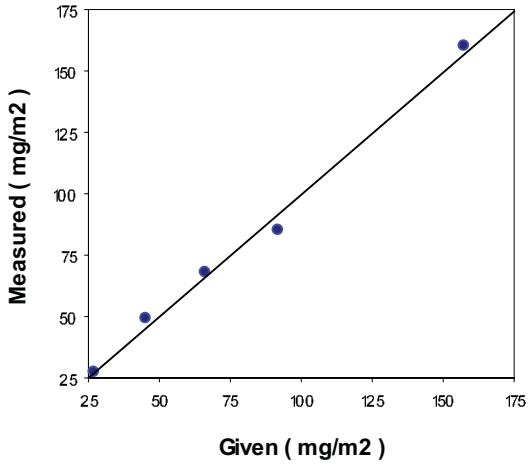
Element	Count Time	MDL
Si	300 sec	0.0006 g/m²

Results for the Si on Paper (Low Range)

Calibration for Si on Paper (Low Range)

Element: Si	Std. Error of Estimate: 4.66594	
Units: mg/m²	R.M.S.: 1.61405	
Sample	**Given**	**Measured**
1	157.7	159.84
2	92.1	85.14
3	66.5	67.71
4	45.6	48.83
5	26.8	27.17

Correlation Plot for Si



Precision for Si on Paper (Low Range)

10 repeat analyses at 300 seconds per measurement

Element: Si		Units: mg/m²		
Sample	**Given**	**Mean**	**Std. Dev.**	**% Rel.**
1	157.7	158.14	0.45	0.3
3	26.8	27.29	0.36	1.3

Minimum Detection Limit (MDL)
Si on Paper (Low Range)

The Minimum Detection Limit (MDL) for an element is determined as three times the standard deviation of ten analyses of the blank sample. The following MDL was derived using this empirical method and applies to this matrix and concentration range.

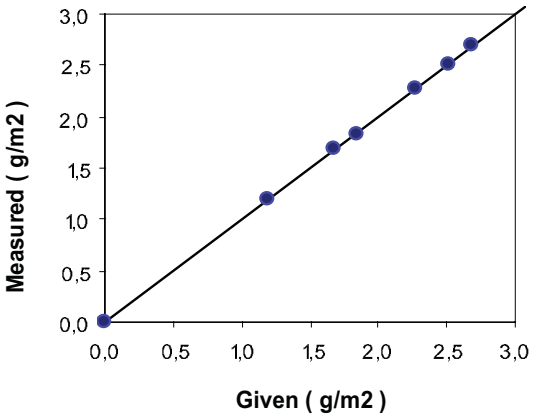
Element	Count Time	MDL
Si	300 sec	0.60 mg/m²

Results for the Si on Clay-coated Paper

Calibration for Si on Clay-coated Paper

Element: Si	Std. Error of Estimate: 0.049108	
Units: g/m²	R.M.S.: 0.0013	
Sample	**Given**	**Measured**
1	2.69	2.690
2	2.51	2.514
3	2.28	2.278
4	1.84	1.834
5	1.68	1.679
6	1.19	1.195
7	0.00	-0.001

Correlation Plot



Precision for Si on Clay-coated Paper

10 repeat analyses at 200 seconds per measurement (400 seconds total analysis time)

Element: Si		Units: g/m²		
Sample	**Given**	**Mean**	**Std. Dev.**	**% Rel.**
1	2.69	2.675	0.011	0.4
6	1.19	1.207	0.005	0.4

Minimum Detection Limit (MDL)

Si on Clay-coated Paper

The Minimum Detection Limit (MDL) for an element is determined as three times the standard deviation of ten analyses of the blank sample.The following MDL was derived using this empirical method and applies to this matrix and concentration range.

Element	Count Time	MDL
Si	200 sec	0.020 g/m^2

Conclusion

As can be seen from the above data, the use of the PHOENIX II XRF system gives excellent performance when applied to the determination of Si coatings on paper and clay-coated paper. Results are rapid, precise and analysis is easily carried out, even by non-laboratory personnel. Because no consumable chemicals are used, the relative ”cost of ownership“ is much lower than other analytical techniques.

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