ASOMA® Application Note

ASOMA® PHOENIX II

Determination of Zinc Coating on Steel

Summary

All samples were analyzed using the PHOENIX II XRF Benchtop system. This report demonstrates the capability of the PHOENIX II to measure zinc coat weight on steel.

Zinc is a primary coating used to protect steel against oxidation and corrosion. Galvanization is the most common form of applying zinc coatings on steel, and include hot-dip, anodizing or annealing processes.

Proper monitoring of coat weight is important. Over coating may cause loss of quality and undue over expense. Under coating causes loss of quality. Coating measurements require little sample preparation. Simply cut a sample panel, place it in the sample chamber and analyze.

These benefits work together to maximize quality and reduce operational costs.

Introduction

The PHOENIX II is an excellent XRF benchtop coating thickness analyzer either at-line production QC analysis or in the laboratory. The PHOENIX II offers a fast, precise, simple and non-destructive analysis technique well suited for the determination of coating thickness (as given by coat weight) on steel or aluminum substrates. Galvanization makes use of zinc coatings. As hexavalent chromium is being phased out of use, secondary conversion coatings to replace chromate include titanium, vanadium and zirconium. Coating used as both a paint primer and tooling preparation include phosphate compounds and silicon compounds (silane, silicone, etc.)

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. 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 a measurement time of 100 seconds.

Sample Preparation

Simply cut an approximately 3X5 inch square or disk panel and place it coating side down over the aperture in the sample chamber. Sample panels can be as small as 2X2 inch square or circular to a minimum of 30 mm diameter.

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 zinc or chromate or titanium, etc.) 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; Moveable secondary target; Detector filters; Polypropylene 4.0 µm film

Note: No consumable gases required.

Typical sample panel shown in analysis position

Note:

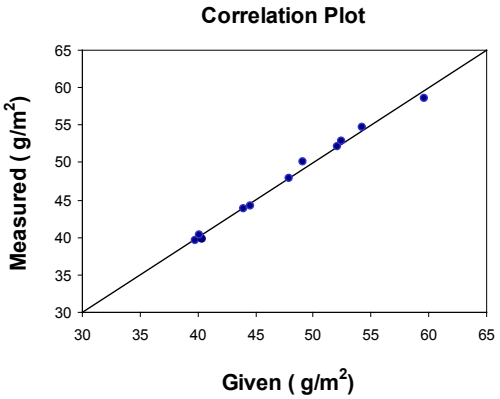
Hot-dip galvanizing can produce a spangled surface pattern. For the most accurate results when measuring spangled surface, it is recommended to use a Sample Spinner.

The following results section show performance for a typical zinc coating on galvanized steel. The PHOENIX II is equipped to measure many others. Please contact AMETEK for more information.

Results

Calibration for Zn on Galvanized Steel

Element: Zn	**Std. Error of Estimate: 0.0020**	
Units: g/m²	**RMS: 0.15896**	
Sample	**Given**	**Measured**
#2 bottom	39.8	39.65
#3 bottom	54.2	54.78
#4 top	47.9	47.93
#6 bottom	40.4	39.84
#10 top	40.1	40.30
#12 top	52.4	52.86
#12 bottom	49.1	50.03
#13 top	52.1	52.16
#15 top	44.6	44.196
#16 top	44.0	43.89
#17 top	59.6	58.55



Precision for Zn on Galvanized Steel

10 repeat analyses at 100 seconds per measurement

Element: Zn		Units: g/m²		
Sample	**Given**	**Mean**	**Std. Dev.**	**% Rel.**
#2 bottom	39.8	39.37	0.11	0.3
#12 bottom	49.1	50.08	0.17	0.3
#17 top	59.6	59.06	0.18	0.3

Minimum Detection Limit (MDL)

Zn on Galvanized Steel

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

Element	Count Time	MDL
Zn	100 sec	0.006 g/m²

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 zinc coating on steel. 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.

Determination of Zinc Coating on Steel

ASOMA®
Application Note

AMETEK®
PROCESS INSTRUMENTS

150 Freeport Road, Pittsburgh PA 15238
Ph. +1-412-828-9040, Fax +1-403-826-0399
www.ametekpi.com

REGISTERED ISO 9001 MANAGEMENT SYSTEM

F-0277 Rev. 2 (0511)

One of a family of innovative process analyzer solutions from AMETEK Process Instruments.
Specifications subject to change without notice.

SALES AND MANUFACTURING:

CANADA - Alberta
2876 Sunridge Way N.E., Calgary, AB T1Y 7H9 • Tel: +1-403-235-8400, Fax: +1-403-248-3550

USA - Delaware
455 Corporate Blvd., Newark DE 19702 • Tel: +1-302-456-4400, Fax: +1-302-456-4444

USA - Oklahoma
2001 N. Indianwood Ave., Broken Arrow OK 74012 • Tel: +1-918-250-7200, Fax: +1-918-459-0165

WORLDWIDE SALES AND SERVICE LOCATIONS:

USA - Texas
Tel: +1-512-252-2440, Fax: +1-512-252-2430

CHINA
Beijing / Tel: 86 10 8526 2111, Fax: 86 10 8526 2141
Chengdu / Tel: 86 28 8675 8111, Fax: 86 28 8675 8141
Guangzhou / Tel: 86 20 8363 4768, Fax: 86 20 8363 3701
Shanghai / Tel: 86 21 5868 5111, Fax: 86 21 5866 0969

FRANCE
Tel: 33 1 30 68 89 20, Fax: 33 1 30 68 89 29

GERMANY
Tel: 49 21 59 91 36 0, Fax: 49 21 59 91 3639

INDIA
Tel: 91 90 6782 3200, Fax: 91 80 6782 3232

SINGAPORE
Tel: 65 6484 2388, Fax: 65 6481 6588