

SCOPE

The measurement of titanium (Ti) conversion coating on galvanized steel is demonstrated.

BACKGROUND

Aluminum and steel are often coated with a protective conversion coating, also called passivate or passivation coating, to prevent oxidation and corrosion of the base metal. Conversion coatings include Cr, Ti, V, Mn, Ni, or Zr. A phosphate coating may be applied as well to minimize wear on cutting tools and stamping machines. Aluminum is often coated for use in aircraft parts, aluminum window frames and other similar industries where the aluminum is exposed to weathering. Steel for the automotive industry is typically first galvanized with a zinc coating before the conversion coating is applied. Protected steel is also used for outdoor sheds and other similar uses where steel is exposed to weathering. Conversion coating also help in the retention of paint for the final finished product.



INSTRUMENTATION

Model:	Rigaku NEX QC ⁺
X-ray tube:	50kV 4W Ag-anode
Detector:	High performance SDD
Film:	Mylar
Analysis Time:	100 sec
Atmosphere:	Air



SAMPLE PREPARATION

A test coupon is simply placed flat in the analysis chamber with the coated side facing down towards the X-ray beam. Test coupons must cover the 26mm diameter analysis aperture. Alternately, 32mm or 40mm circles can be cut for use with the autosampler trays. All samples must lie flat and cover the analysis aperture.

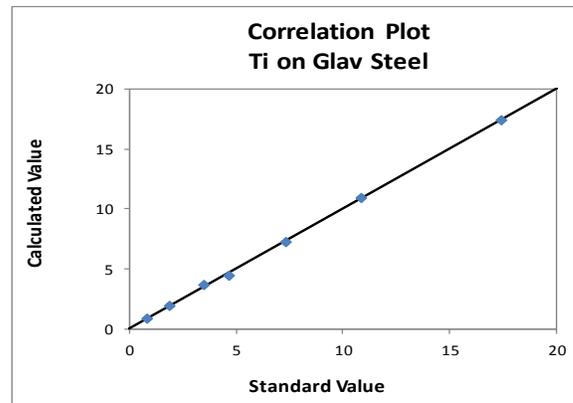
UNITS

1 mg/ft² = 10.8 mg/m²
1 mg/m² = 0.09 mg/ft²

CALIBRATION

An empirical calibration was built using a set of standards assayed by careful weigh-strip-weigh. The bare, uncoated galvanized steel sample was measured to generate special background correction that automatically compensates for the specific amount of background in each individual sample measured. The thickness of the galvanized layer may not be constant and so an automatic correction is enabled that compensates for Zn X-rays effect on the Ti X-ray signal.

Element: Ti		RMS Dev: 0.095
Units: mg/ft ²		R ² Correlation: 0.99974
Sample I.D.	Standard Value	Calculated Value
STD 1	0.83	0.835
STD 2	1.90	1.905
STD 3	3.50	3.643
STD 4	4.64	4.472
STD 5	7.29	7.254
STD 6	10.82	10.883
STD 7	17.43	17.418



RECOVERY & REPEATABILITY

To demonstrate repeatability (precision), the low and high calibration standards were chosen. Each sample was measured in static position for ten repeat analyses using a total analysis time of 100 sec per measurement in air atmosphere, with typical results shown below.

Element: Ti		Units: mg/ft ²		
Sample ID	Standard Value	Average Value	Std Dev	% Relative
STD 1	0.83	0.845	0.024	2.9
STD 7	17.43	17.440	0.069	0.4

DETECTION LIMITS

To determine the Lower Limit of Detection (LLD) ten repeat analyses of the uncoated galvanized steel sample were measured using 100 sec measurement time per sample and the standard deviation was calculated. The LLD is defined as three times the standard deviation.

Element	LLD in mg/ft ²	LLD in mg/m ²
Ti on Galv Steel	0.03	0.32

CONCLUSION

The performance shown here demonstrates NEX QC⁺ provides excellent sensitivity and performance for the measurement of titanium conversion coatings on galvanized steel.