APPLICATION NOTE # XE-2014-3257
Quantitative determination of Ti coating thickness on iron alloy

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ABSTRACT

Two iron alloys were quantitatively analyzed using Xenemetrix EDXRF analyzer, model X-Calibur, equipped wilth Silicon Drift Detector for determination of Ti coating thickness on its surfaces.
The determination of Ti coating thickness was done using fundamental parameter calculations with one commercial reference standard.

OBJECTIVE

- To develop a quick and robust quantitative method for determination of Ti coating thickness on surface of iron alloy.
- To evaluate the instrument performance and method repeatability.

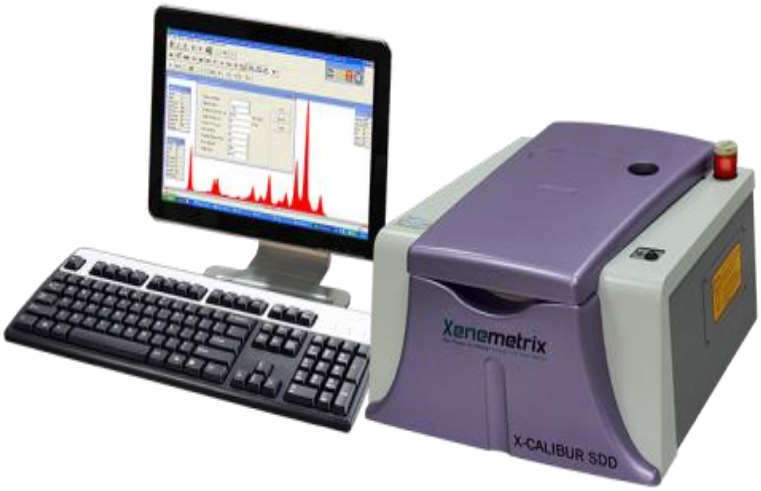
BACKGROUND

EDXRF is an ideal analytical technique for qualitative and quantitative elemental analysis. EDXRF poses many advantages: 1) non destructive technique, 2) samples are analyzed with minimal preparation, 3) simultaneous analysis of many elements, 4) quick technique; typical analysis time is usually a few minutes, 5) ease of use for non-technical stuff, 6)automated analysis process, 7) flexibility of sample form; sample may be solid, powder, liquid or thin film form.
These advantages have increased the popularity of XRF among industries such as chemicals, oil and alloys industries.

Analytical Configuration

Table 1: Instrumental analytical configuration

Instrument	X-Calibur
Anode	Rh-Anode X-ray Tube, 50kV, 50W
Detector	Silicon Drift Detector (SDD)
Environment	Air
Excitation mode	Direct excitation
Type of analysis	Quantitative analysis
Analysis time	150 sec
Sample Preparation	No sample preparation



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EXPERIMENTAL and RESULTS

Two iron alloys, 9 and 10, were received for determination of titanium coating thickness on its surfaces using fundamental parameter calculations.

Qualitative analysis of Fe alloy coated by thin film of Ti

Each alloy was placed "as is" in the sample tray and analyzed. Typical spectrum of iron alloy coated by Ti thin film is shown in figure 1.

Quantitative analysis of Fe alloy coated by thin film of Ti

Each sample was measured 10 times consecutively without moving the sample in between acquisitions. The spectral data were analyzed using fundamental parameter calculations. Type reference standard (material with known Ti thin film thickness and matrix similar to unknown samples) was used to calculate theoretical calibration coefficient used in the FP calculations.

Individual results and measured average thickness ±1 standard deviation are shown in table 2.

Figure 1: Typical spectrum of Fe alloy coated by Ti thin film

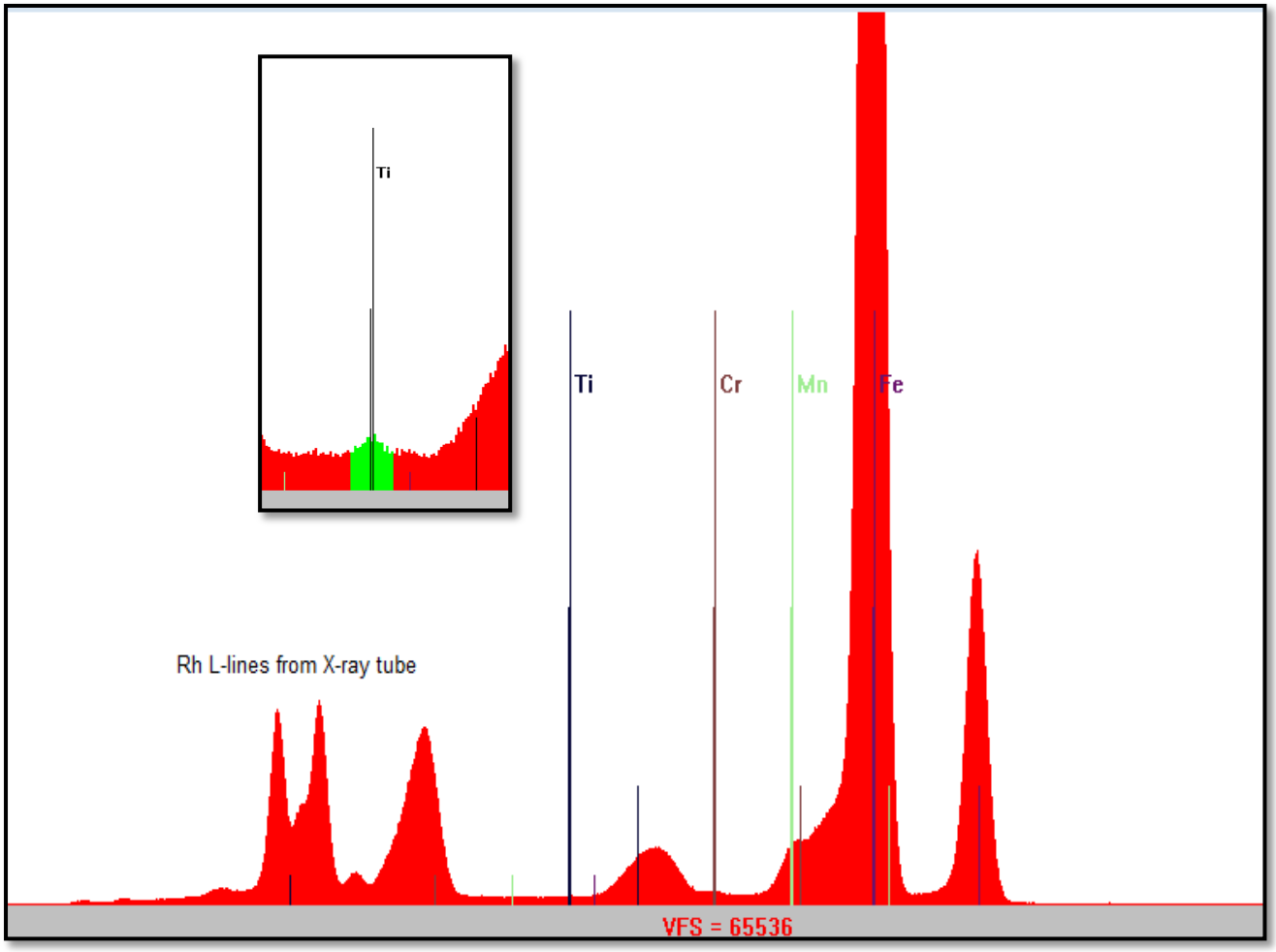

Table 2: Quantitative analysis results

repeat #	sample 9 - Ti thickness [µg/cm^2]	sample 10 - Ti Thickness [µg/cm^2]
1	0.30	0.08
2	0.31	0.09
3	0.30	0.07
4	0.31	0.08
5	0.34	0.09
6	0.32	0.07
7	0.31	0.07
8	0.27	0.08
9	0.32	0.09
10	0.32	0.08
Average [µg/cm^2]	**0.31**	**0.08**
Std. Dev. [µg/cm^2]	**0.02**	**0.01**

CONCLUSION

This study shows the excellent use of the X-Calibur system equipped with a SDD detector to perform simple, rapid and non destructive quantitative elemental analysis for determination of coating thickness on surface of iron alloy. In the absence of standards, fundamental parameters software with one commercial standard provides good results.