SHIMADZU

Application News

X-ray Analysis No.X237

Comparison of Calibration Curves of Lead, Cadmium and Chromium in Zinc Alloy and Copper Alloy

X-ray fluorescence analysis allows for the non-destructive analysis of solid, powder and liquid samples, both quickly and easily. For that reason it is widely used as a screening method for RoHS/ELV compliance testing.
In this Application News, we compared the calibration curves for Zn alloy and Cu alloy, and present our examination of their applicable ranges. For a detailed evaluation of a Zn alloy standard sample and a Cu alloy sample, please refer to Application News X236 and X225, respectively.

■ Samples

MBH Analytical Ltd. Zn Alloy Certified Reference Materials (Photograph 1)

Sample	Content (ppm)			
	Cd	Pb	Hg	Cr
41X ZSC1	288	621	260	39
41X ZSC2	16	1111	53	36
41X ZSC3	1190	273	21	148
41X ZSC4	131	1560	500	299
41X ZSC5	502	137	1470	0
41X ZSC6	2150	77	290	0

Sumitomo Metal Technology, Inc. Cu Alloy Samples (Photograph 2)

Sample	Content (ppm)		
	Cd	Pb	Cr
GBR1	0	0	0
GBR2	60	1000	960
GBR3	20	200	450
GBR4	40	100	1120
GBR5	170	1200	70
GBR6	140	510	160

(Photograph 1)

(Photograph 2)

■ Calibration Curves

The calibration curves for four elements (Pb, Cd, Hg, and Cr) in Zn alloy and Cu alloy are shown in Figs. 1 – 5, respectively (Hg present in Zn alloy only).

The slopes of the calibration curves for three elements (Pb, Cd, Cr) were nearly the same with respect to their content levels in the Zn alloy and Cu alloy. This means that the Zn alloy calibration curve and Cu alloy calibration curve can be used interchangeably with respect to analysis of these elements.
Hg is the one element among these that is present only in the Zn alloy reference sample, but since the other three elements (Pb, Cd, Cr) are present at the same levels in both alloys, the Zn alloy calibration curve can be used for analysis of Hg in Cu alloy.

■ Comparison of Quantitative Analysis Results

The quantitative analysis results for a Zn alloy sample and a Cu alloy sample obtained using their respective calibration curves are shown below. It is clear that the quantitation results from the two calibration curves show almost the same values.

Table1 Comparison of Quantitative Analysis Results

Quantitation Element		Cd	Pb		Hg	Cr
Spectrum		Cd Kα	Pb $Lβ_1$	Pb Lα	Hg $Lβ_1$	Cr Kα
Zn alloy (41× ZSC4)	Standard value	131	1560	1560	500	299
	Quantitation value by Cu alloy calibration curve	130.7	1586	1623	–	267.6
	Quantitation value by Zn alloy calibration curve	134.7	1533	1607	528.9	298.0
Cu alloy (GBR 2)	Standard value	60	1000	1000	–	960
	Quantitation value by Cu alloy calibration curve	59.6	1029	1039	–	928.2
	Quantitation value by Zn alloy calibration curve	57.1	1005	1061	N.D.	1013

(Unit: ppm)
N.D.: Not Detectable

The calibration curves generated using reference samples of the Zn alloy and Cu alloy are shown in Figs. 1 – 5.

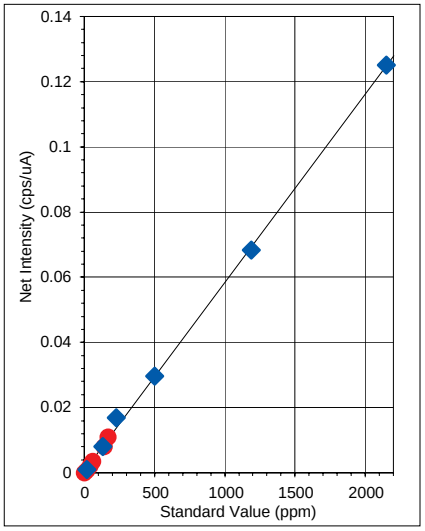

Fig. 1 Calibration Curve for Cd Kα

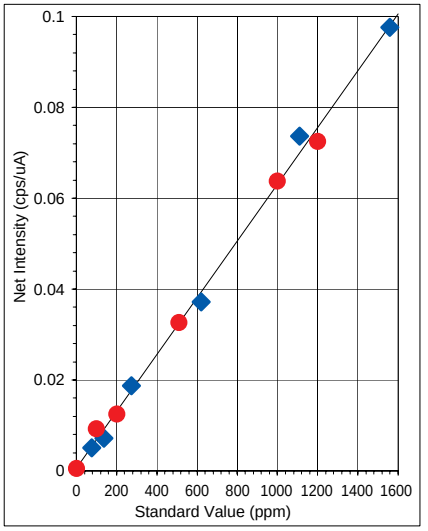

Fig.2 Calibration Curve for Pb $L\beta_1$

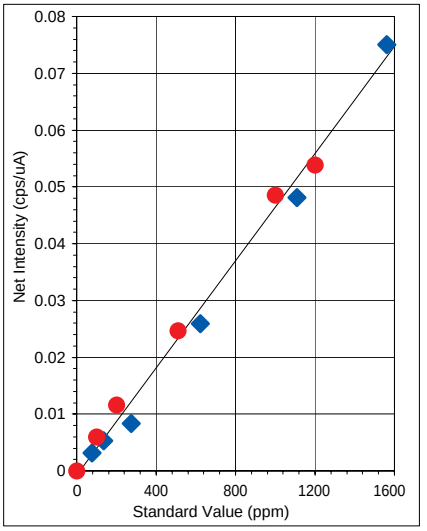

Fig. 3 Calibration Curve for Pb Lα

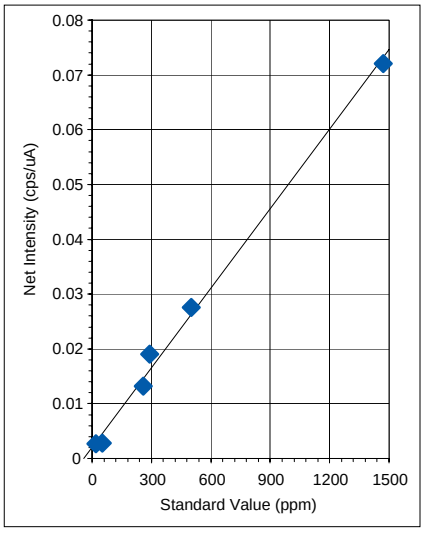

Fig.4 Calibration Curve for Hg $L\beta_1$

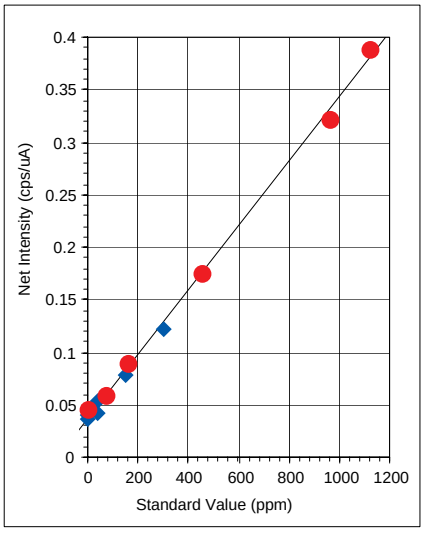

Fig.5 Calibration Curve for Cr Kα

◆ Zn alloy calibration curve

● Cu alloy calibration curve

Table 2 Analytical Conditions

Instrument	: EDX-720, GP
X-Ray Tube	: Rh target
Filter	: EDX-720: Filter #4 (for Cd), Filter #3 (for Hg, Pb), Filter #2 (for Cr)
	EDX-GP: Filter #1 (for Cd), Filter #4 (for Hg, Pb), Filter #3 (for Cr)
Voltage - Current	: 50 kV - (Auto) μA except for Cr, Cr: 30 kV - (Auto) μA
Atmosphere	: Air
Measurement Diameter	: 10 mmø
Measurement Time	: 300 sec
Dead Time	: 40%

NOTES:

✻This Application News has been produced and edited using information that was available when the data was acquired for each article. This Application News is subject to revision without prior notice.

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Printed in Japan 3295-12902-10A-IK