Application Brief

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SFT NO.25 AUG.2006

Coating Thickness Measurement with Hazardous Substance Primary Filters
— Au/Pd/Ni/Phosphor Bronze Triple Layer

1. Introduction

The SEA5120A employs 3 primary filters (for Cd, for Pb, for Cr) to enable high sensitivity measurement of RoHS directive elements (Cd, Pb, Br, Hg, Cr). But elements that are able to efficiently use the primary filters are not limited to RoHS directive elements. This application brief applies to coating thickness measurements using hazardous substance primary filters and introduces an example of an ultra thin film measurement.

2. Measurement

Au/Pd/Ni/phosphor bronze (base thickness is approximately 80um) three layer coating was measured using the SEA5120A. Table 1 shows the measurement conditions.

Table 1 Measurement Conditions

	Condition ①	Condition ②
Measurement Time (sec)	300	300
Collimator Size (mm)	1.0	1.0
Excitation Voltage (kV)	50	50
Current (mA)	20	384
Filter	none	For Pb

3. Analysis Results

Figure 1 shows a spectrum measurement not using filters. Figure 2 shows a spectrum measurement using a spectrum. The background tends to be high because the thickness of the base material in the sample is thin, but as can be seen here, the P/B (peak to background) ratio of Au and Pd is improved by using a primary filter. Table 2 shows the results of 20 measurements at the identical location using both conditions. Dispersion of Au and Pd decreased because sensitivity improved by the amount that the P/B ratio improved with the primary filter.

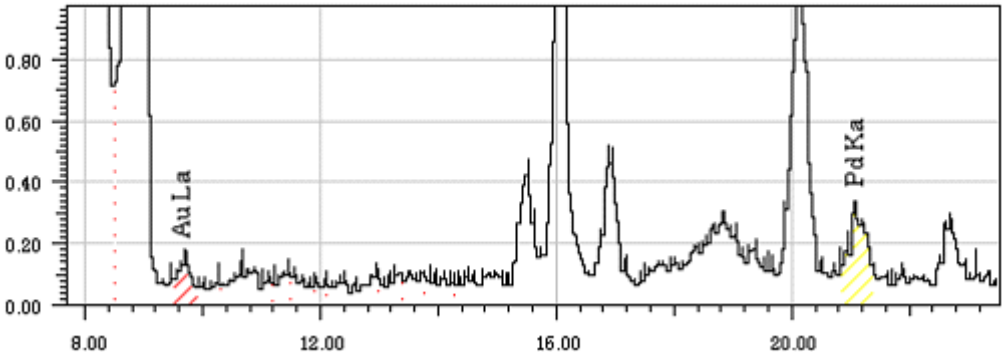

Figure 1 Spectrum when measured without using filter

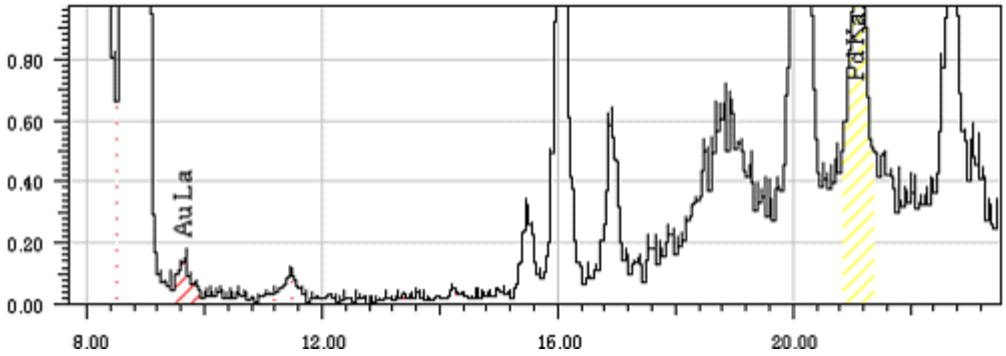

Figure 2 Spectrum when measured using filter

Table 2 Repetition Measurement Results (n=20)

Cond.	Element	Average (Å)	Standard Deviation (Å)	Maximum (Å)	Minimum (Å)	Range (Å)	CV (%)
①	Au	15	2.8	20	8	12	17.9
	Pd	325	24.5	377	277	100	7.5
	Ni	6247	32.2	6316	6202	114	0.5
②	Au	15	2.1	19	12	7	13.9
	Pd	333	14.1	360	304	56	4.2
	Ni	6219	78.4	6394	6108	286	1.3

The quantitative lower limits of Au and Pd in this sample when using a primary filter for measuring hazardous substances are as shown in Table 3. This time, quantitative lower limits are defined as thickness corresponding to 10 times the standard deviation of the intensity obtained from 10 measurements of a blank sample (phosphor bronze of near equal thickness). Here we see that the quantitative lower limit decreased by using a primary filter.

Table 3 Repeatable Measurement Results (n=20)

	Element	BG Average Intensity (cps)	Standard Deviation (cps)	Quantitative Lower Limit (Å)
With filter	Au	1.344	0.069	14
	Pd	4.976	0.197	269
Without filter	Au	1.921	0.073	11
	Pd	22.507	0.289	111

4. Conclusion

We see that measurement dispersion can be decreased by applying the primary filter for hazardous substance measurements to this type of application. The quantitative lower limit decreases, Au at 11Å and Pd at 111Å, and is very effective in measuring ultra thin coatings. However, conversely, since sensitivity decreases when using a primary filter and a 0.1mm collimator, it should only be applied in cases when a range wider than 1mm can be ensured.