Application Brief

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SFT NO.5 JUL.1998 Ultra-thin Au Coating Measurements

1. Overview

Ultra thin Au coating of less than 0.05 um cannot be measured by the SFT3000 series because of resolution limitations of the detector used in the SFT fluorescent X-ray coating thickness gauge. Employing a high resolution semi-conductor detector in SEA5120 series machines has greatly improved the signal to noise ratio and made possible measurement of Au thin films with thickness' of 30 to 100 angstroms.

2. Difference in Detector Resolution

Figure 1 shows a comparison of resolutions of the SFT series detector (proportional counter) versus the SEA5120 detector (semi-conductor or SSD). The measurement sample is Au standard foil (0.042 um) on a Cu plate. Measurement conditions are listed in Table 1.

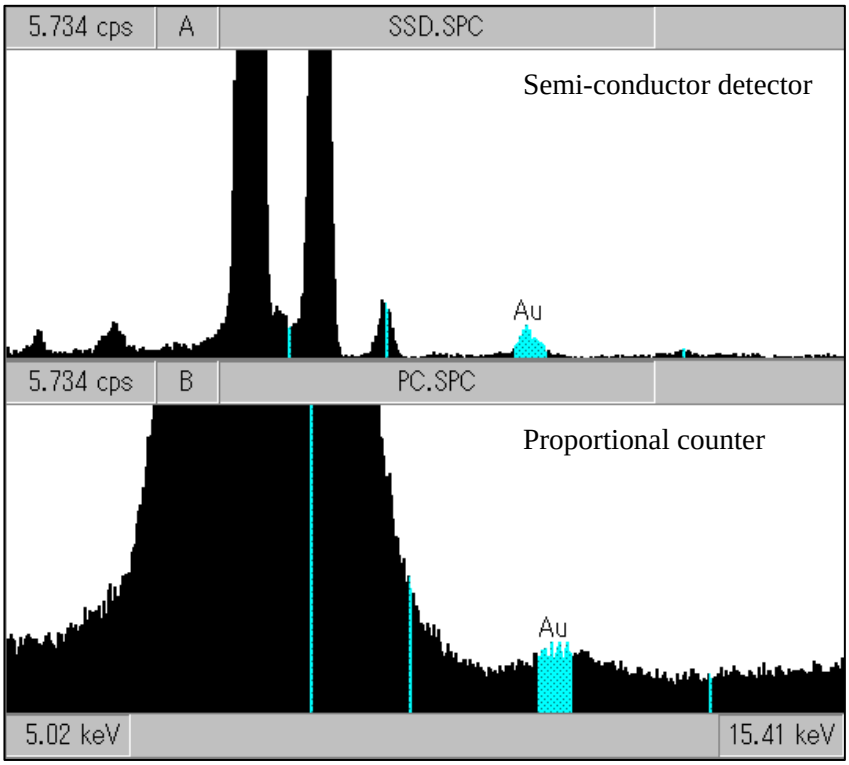

Figure 1 Comparison of detectors of each detector

Table 1 Measurement Conditions

	SEA5120 (SSD)	SFT3000S (PC)
Collimator	0.1 mm	0.1 mm
Tube Voltage	50 kV	45 kV
Tube Current	1 mA	1 mA
Target material	Mo	W
Measurement Time	100 seconds	100 seconds
Atmosphere	Air	Air

Table 1 shows that the SSD resolution is greatly superior and has a high S/N ratio.

3. Detection Sensitivity and Quantitative Lower Limits

This section describes differences of detection sensitivity and detection lower limit between the SEA5120 and SFT3000S. Measurement conditions are the same as in Table 1. Three Au samples points were used to crease the calibration curve: 0.042 um, 0.1 um, and 0.25 um.

Figure 2 shows differences in detection sensitivity. The slope of the SEA5120 calibration curve has a high sensitivity. This results from using a Mo tube that has high excitation efficiency. Here the calibration curve displayed plots thickness versus intensity ratio. Standardizing by intensity ratio when the Au infinite intensity ratio is 1 allows us to compare both as absolute intensities.

Figures 3 and 4 show calibration curves of SEA5120 and SFT3000S with absolute intensities. Intersection of the calibration curves is background intensity. 10 sigma of the dispersion is shown, in Figure 2, to be the quantitative lower limit. The detection lower limit improved 10 times. The detection lower limit here is a target value since dispersion of the calibration curve itself is not evaluated.

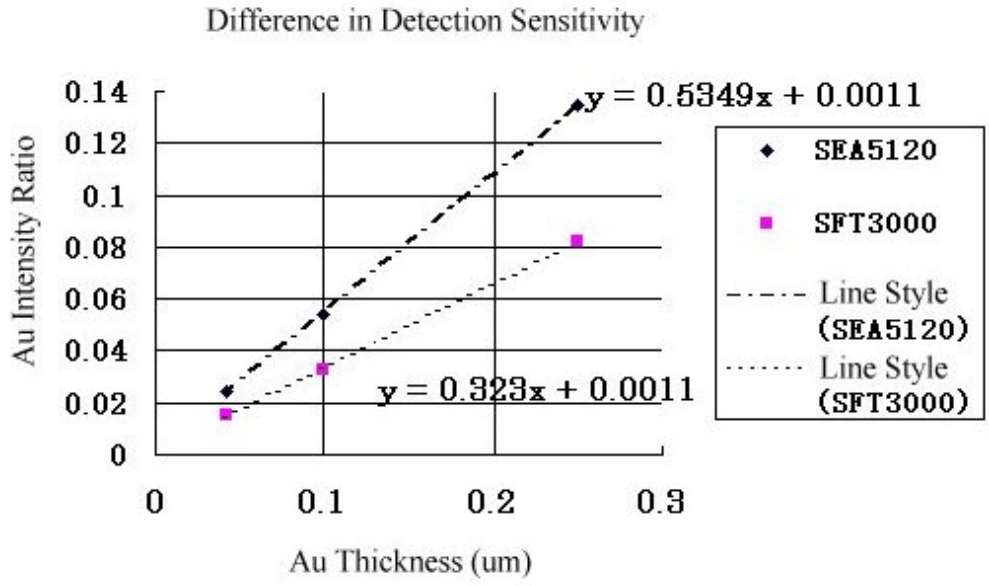

Figure 2 Comparison of Detection Sensitivities

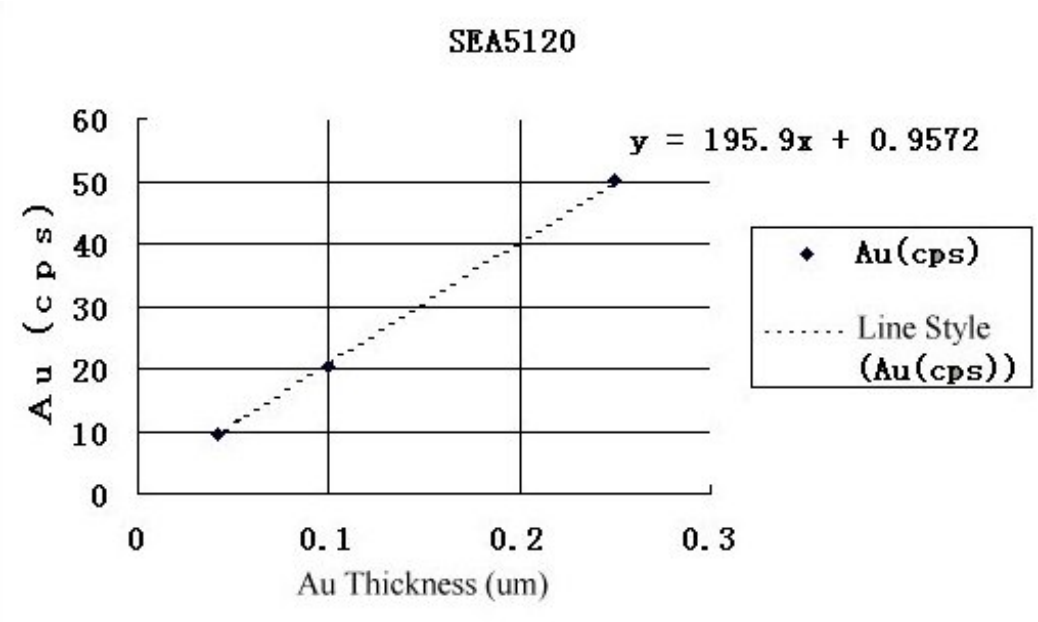

Figure 3 SEA5120 Calibration Curve (Absolute Intensity)

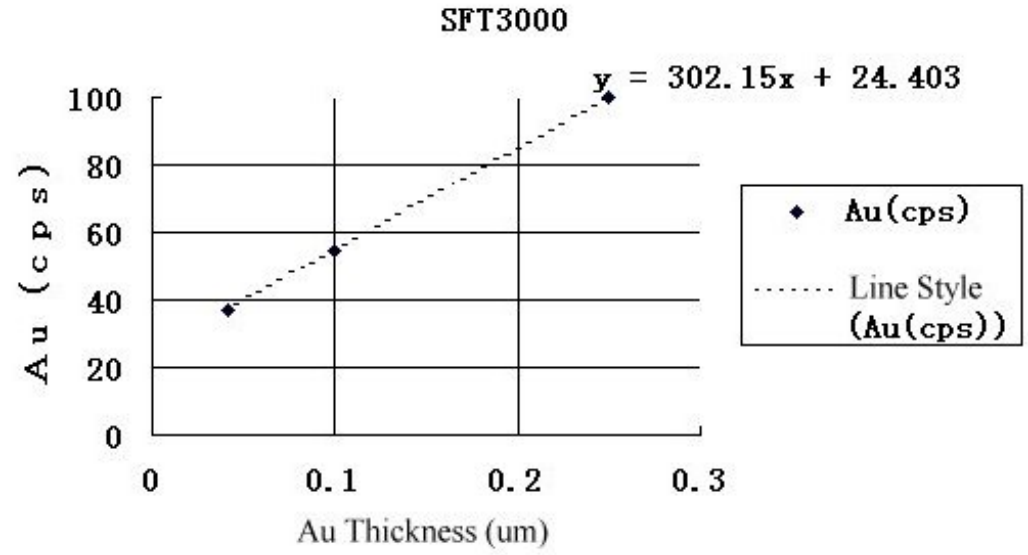

Figure 4 SFT3000 Calibration Curve (Absolute Intensity)

Table 2 Quantitative Lower Limit Comparison

	SEA5120	SFT3000S
Collimator	0.1 mm	0.1 mm
Measurement Time	100 seconds	100 seconds
Quantitative Lower Limit	0.005 um	0.03 um