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Measurement of Sn/Ni Layer in Ceramic Chip Component using FT150h

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Ceramic chip components such as multilayer ceramic chip capacitors are core elements of smart phones and in-vehicle computers. Recently, these devices have been shrinking in dimension because of the demands for a higher level of integration and increased functionality. It is necessary to control the thickness of the Sn and Ni layers in the electrodes of ceramic chip components. However, using X-ray fluorescence, it is difficult to simultaneously determine the thickness of the Sn and Ni layers, because a thick Sn layer strongly absorbs the fluorescence X-rays originating from Ni.

Equipped with a new x-ray collecting optical system and a Vortex detector, the FT150h allows simultaneous thickness measurements of a thick Sn layer and a Ni layer within a micro-spot region, which is difficult using a conventional instrument.

In this case study, the thicknesses of a Sn and Ni layer on Ag are measured simultaneously in a simulated sample of a ceramic chip component.

FT150 Series

Measurement of Thickness of Sn and Ni Layers

Measurement conditions and standard samples

Table 1 Measurement conditions

Instrument	FT150h
Tube voltage	45 kV
Beam diameter Note	35 μm ϕ
Primary filter	Al1000
Measurement time	30 s
Measurement method	Thin Film FP
Analysis line	Sn Kα Ni Kα Ag Kα

Note: Defined as the diameter that encloses 90% of primary X-rays with an energy of 30 to 40 keV.

An Al substrate covered by thin-film standard materials (Sn 4.61 μm, Ni 4.89 μm, Ag 8.95 μm) made by Hitachi High-Tech Science Corporation is registered as a reference material.

Samples

The measured samples consisted of the thin-film standard materials made by Hitachi High-Tech Science Corporation listed in Table 2.

Table 2 Specifications of measured samples

	Sn (μm)	Ni (μm)	Ag (μm)
(1)	2.01	1.90	8.95
(2)	4.61	1.90	8.95
(3)	9.43	4.89	8.95

Comparison of Sn Kα spectra

A Sn layer with a thickness of about 5 μm was measured using the FT150h and a conventional FT9500X.

The FT150h with the new x-ray capillary system and the Vortex detector dramatically increased the intensity for the difficult-to-detect Sn Kα peak.

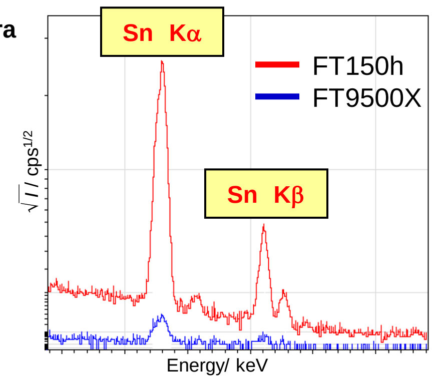

Figure 1 Comparison of Sn spectra

Thickness measurement results *

Measurements were repeated 10 times and the precision and repeatability for the Sn and Ni thicknesses were evaluated.

Table 3 Thickness results for sample (1)

	Sn (μm)	Ni (μm)	Ag (μm)
Average	2.01	1.94	8.89
Standard deviation	0.051	0.037	0.046
RSD%	2.5%	1.9%	0.5%

Table 4 Thickness results for sample (2)

	Sn (μm)	Ni (μm)	Ag (μm)
Average	4.63	1.93	8.82
Standard deviation	0.049	0.043	0.050
RSD%	1.1%	2.2%	0.6%

Table 5 Thickness results for sample (3)

	Sn (μm)	Ni (μm)	Ag (μm)
Average	9.36	4.65	8.84
Standard deviation	0.068	0.164	0.122
RSD%	0.7%	3.5%	1.4%

For each sample, 10 measurements were performed, each for 30 seconds. Good repeatability was achieved, with a relative standard deviation (RSD) of less than 4%. Also, the thickness of the Ni layer could be accurately measured even under a Sn layer with a thickness of 10 μm.

Thus, the FT150h enables simultaneous high-precision measurement of Sn and Ni layers within a micro-spot region, which is difficult using a conventional instrument.

*These are example measurements and do not guarantee the performance of the instrument.

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