APPLICATION NOTE - 013

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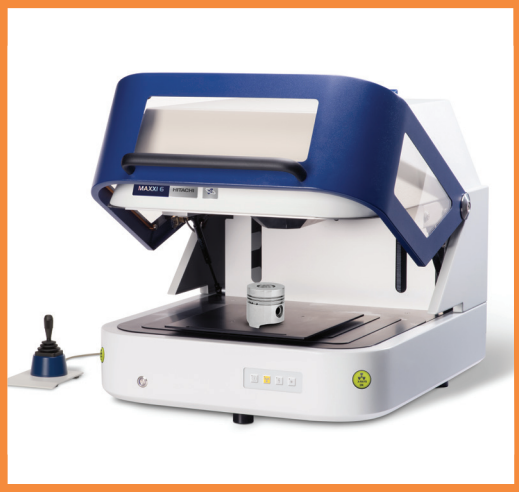
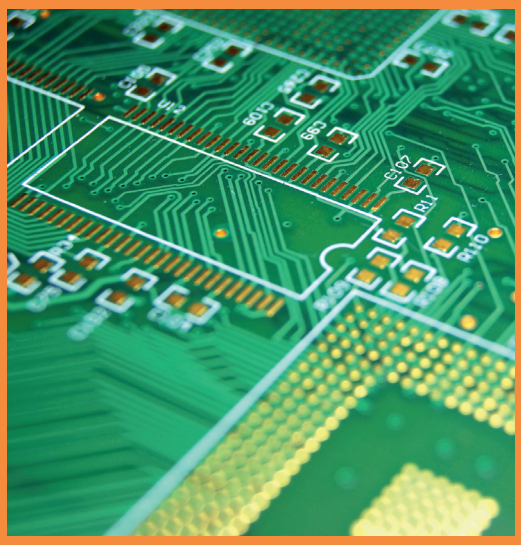
MAXXI 6



Analysis is as easy as: load, focus, start



Analysis of gold coatings

INTRODUCTION

Gold plating is used in applications where high conductivity is required and corrosion resistance is critical. Gold offers good electrical conductivity, but its relative softness and low melting temperature may be the limiting factors. Gold is one of the precious metals that have excellent solder-ability, weld-ability and infrared reflectivity. Most commonly, gold is plated in the range from 0.05 to 8.0 microns.

Gold is primarily used in the electrical industry for connectors and printed circuits, and in the electronics industry for transistor integrated circuits. The use of gold in these industries is attributed to the fact that it is the only metal that will meet the stringent performance and property requirements. The excellent physical and chemical resistant properties offset the high price of gold. Also, gold is also commonly flashed over brass jewelleries or other metal to achieve the desired appeal, colour, and to prevent tarnishing.

To guarantee the good functionality of the plated components, platers need to ensure a consistent gold thickness. The MAXXI 6 offers rapid and accurate, non-destructive analysis of gold coatings with high degree of confidence, with minimal or no sample preparation needed. The system is extremely easy to operate by non-technical staff.

Its robust and rugged design is well suited for the most challenging industrial conditions.

Hitachi's family of bench-top EDXRF analysers have been employed in the field for over twenty years and have served as the cost effective solution for gold coating thickness measurements.

MAXXI 6

Hitachi's MAXXI 6 is a high performance, compact, rugged and reliable quality control analyser for simple, rapid, coating thickness measurement and composition analysis. Measurements can be made according to international test methods ISO 3497 and ASTM B568. The MAXXI 6 uses the latest generation silicon drift detector (SDD) technology to provide the ultimate resolution and sensitivity.

The MAXXI 6 uses the non-destructive analytical technique of energy dispersive X-ray fluorescence (EDXRF) to generate an X-ray spectrum of the sample. This elemental X-ray spectrum is processed using the supplied Fundamental Parameters (FP) or empirical software to produce coating thickness or composition values.

The MAXXI 6 includes as standard features that make it an ideal fit for coatings analysis. The large, slotted sample chamber can fit a wide range of parts. The motorised sample stage makes it easy to automatically measure multiple samples or multiple features on a single sample, or perform scans to get a representative analysis on uneven surfaces. Multiple collimators are included in the instrument to ensure the best fit and performance on parts of all sizes.

INTUITIVE SMARTLINK SOFTWARE MAXIMIZES USER PRODUCTIVITY TO ENSURE CONSISTENT PROCESS AND PRODUCT QUALITY

All instrument functions are driven by Hitachi's SmartLink software program which is a highly intuitive, Microsoft Windows 10 compatible analytical and user interface package. Minimum staff training is required, and the simple user interface enables users at all levels to generate reliable data.

- View the sample and measurement location with clarity.
- Configure results to display pass/fail messages for rapid evaluation.
- Automatically export results to a spreadsheet program.
- Create automatic programs to measure multiple features or samples.
- Get full access to the complete analytical package for thickness, materials and solution analysis at no additional cost.

PERFORMANCE AND RESULTS

Typical performance for common, representative applications is shown in the tables below. The precision was calculated from 30 repeat measurements. Precision is influenced by measurement time, collimator size, elements present and thickness range. In some cases the error can be reduced by optimizing the calibration range for specific applications.

Typical Applications

Top Layer	Second Layer	Third Layer	Substrate
Au			Cu, Co
Au	Ni		Cu, Brass, Bronze, CuNi, Ni
Au	Pd		Cu
Au	Pd	Ni	Cu, Brass, Fe

Typical performance for a single-layer application, Au/Cu using a circular collimator with a diameter of 0.3 mm (12 mil)

Analyte	Tested Range	Standard Error	Precision (2σ), 10 repeats
Au	0.089-2.71 µm (3.5-106.7 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.004 µm @ 0.10 µm 0.028 µm @ 1.03 µm (0.15 µin @ 3.9 µin) (1.57 µin @ 40.5 µin)

Typical performance for a dual-layer application, Au/Ni/CuSn using a circular collimator with a diameter of 0.3 mm (12 mil)

Analyte	Tested Range	Standard Error	Precision (2σ)
Au	0.89-0.533 µm (18-73 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.008 µm @ 0.53 µm 0.012 µm @ 0.99 µm [10 repeats] (0.31 µin @ 20.9 µin) (0.5 µin @ 39.0 µin) [10 repeats]
Ni	0.86-4.31 µm (33.9-169.7 µin)	10% relative	0.075 µm @ 4.4 µm 0.041 µm @ 1.77 µm [10 repeats] (3.0 µin @ 173 µin) (1.6 µin @ 69.0 µin) [10 repeats]

Typical performance for a dual-layer application, Au/Pd/Cu using a circular collimator with a diameter of 0.3 mm (12 mil)

Analyte	Tested Range	Standard Error	Precision (2σ), 10 repeats
Au	0.05-0.53 µm (2.0-20.9 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.008 µm @ 0.50 µm 0.003 µm @ 0.25 µm (0.3 µin @ 19.7 µin) (0.1 µin @ 9.8 µin)
Pd	0.8-0.50 µm (3.1-19.7 µin)	10% relative	0.017 µm @ 0.53 µm 0.006 µm @ 0.21 µm (0.7 µin @ 21.0 µin) (0.2 µin @ 8.3 µin)

Typical performance for a triple-layer application, Au/Pd/Ni/Cu using a circular collimator with a diameter of 0.3 mm (12 mil)

Analyte	Tested Range	Standard Error	Precision (2σ)
Au	0.01-0.5 µm (0.39-19.7 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.026 µm @ 0.58 µm (1.0 µm @ 22.9 µin)
Pd	0.02-0.5 µm (0.8-19.7 µin)	10% relative	0.010 µm @ 0.55 µm (3.14 µin @ 21.7 µin)
Ni	2.25-10.1 µm (88.6-397.6 µin)	~15% relative	0.19 µm @ 4.50 µm (7.5 µm @ 177.2 µin)

SUMMARY

The MAXXI 6 reliably offers precise analysis of gold coatings. Using Hitachi's traceable calibration standards, routine production samples can be simply and quickly measured by any level of operator. Results appear in seconds, allowing near-instantaneous optimisation of the production process.

Over 1,000 applications have been optimized for Hitachi's coatings analysers. For information about additional applications please contact our experts at contact@hitachi-hightech-as.com.

Where every mil or micron counts, depend on Hitachi's coatings analyzers.

Visit **www.hitachi-hightech.com/hha** for more information.

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