

FT160

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Analysis of Nickel Coatings

INTRODUCTION

Nickel plate, with or without an underlying copper strike, is one of the oldest protective and decorative electrodeposited metallic coatings for steel, brass, and other base metals. Recently, it has been applied to plastics of various kinds. Electrodeposits of nickel possess a wide variety of properties, depending on composition of the plating bath and operating conditions.

Electroless nickel coatings are frequently applied on aluminum to provide a solderable surface and are used with molds and dies to improve lubrication and part release. Because of these properties, electroless nickel coatings have found many applications, including those in petroleum, chemicals, plastics, optics, printing, mining, aerospace, nuclear, automotive, electronics, computers, textiles, paper, and food machinery.

Some advantages of electroless nickel coating are good resistance to corrosion and wear, excellent uniformity, solderability and brazability, and relatively low labor costs. Limitations are the high chemical cost, brittleness, poor welding characteristics of nickel phosphorus deposits, the need to copper strike plate alloys containing significant amounts of lead, tin, cadmium, and zinc before electroless nickel can be applied, slower plating rate compared to electrolytic method.

To guarantee the good functionality of the plated components, platers need to ensure a consistent nickel thickness. The FT160 offers rapid and accurate, nondestructive analysis of nickel 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.

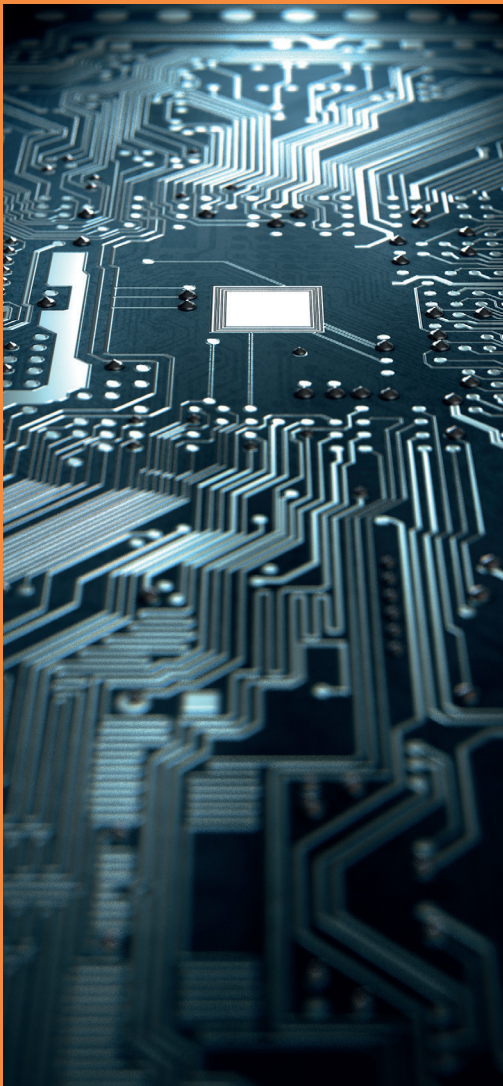
Hitachi High-Tech Analytical Science's family of bench-top EDXRF analyzers have been employed in the field for more than 45 years and have served as the cost-effective solution for nickel coating thickness measurements.

INSTRUMENTAL

FT160

The Hitachi High-Tech Analytical Science **FT160** is a high performance, compact, rugged and reliable quality-control analyzer for simple rapid coating thickness measurement and composition analysis. Measurements can be made according to international test methods, ISO 3497 and ASTM B568. The **FT160** uses the latest generation silicon drift detector (SDD) combined with polycapillary technology to provide the ultimate resolution and sensitivity for small measurement areas.

The **FT160** 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 **FT160** includes as standard features that make it an ideal fit for coatings analysis. The large, sample chamber options can fit a wide range of parts. The motorized 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. The 30 μm beam diameter ensures the best analysis performance of ultra-thin films, lead frame micro-connectors and printed circuit boards.

Intuitive XRF Controller software maximizes user productivity to ensure consistent process and product quality

All instrument functions are driven by Hitachi High-Tech Analytical Science's **XRF Controller** 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 for rapid evaluation
- | Automatically export results to a spreadsheet program
- | Create automatic programs to measure multiple features or samples
- | Options include software for materials and solution analysis.

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, beam size, elements present and thickness range. In some cases, the error can be reduced by optimizing the calibration range for specific applications.

Table 1: Typical Applications

Top Layer	Substrate
Ni	Cu, CuFe, Brass, Bronze, CuNi, CuNiZn
NiP	Cu, Fe, Al, Brass

Table 2: Typical performance for an alloy-layer application, NiP/Cu, using a Mo-target X-ray tube and polycapillary optic with a beam diameter of 30 μm

Analyte	Tested Range	Standard Error	Precision (2σ)
Ni	1.07 - 18.7 μm (42 - 734 μin)	0.025 μm (1 μin) or 5 % relative, whichever is greater	0.03 μm @ 11.3 μm (1.1 μin @ 444 μin)
P	4 - 12 %	2%	0.24 % P @ 9.1 % P

SUMMARY

The **FT160** reliably offers precise analysis of tin coatings. Using Hitachi High-Tech Analytical Science'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 optimization of the production process.

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

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Hitachi High-Tech Analytical Science

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