Product Introduction

Handheld X-ray Fluorescence Analyzer MESA-600/630

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Recently, handheld X-ray fluorescence (XRF) analyzers have been used widely in the field of on-site elemental analysis. Handheld XRF analyses can provide rapid material confirmation, alloy grade identification and field screening of outdoor samples. MESA-600/630 has been greatly improved the usability by new user interface, a large touch screen, and a longer-life battery. Therefore, this analyzer can be applied more flexible to various analytical fields. Additional empirical calibrations using optional software make particular applications such as quality control of special alloy and measurement of plating film thickness. In this article, we introduce features, functions and applications for MESA-600/630.

Introduction

Recently, there has been a growing need for on-site analysis in elemental analysis. For example, there are alloy grade identification for incoming inspection, simple screening for restricted materials, and outdoor analysis for soil. In order to respond to these requests, rapid analysis without depending on sample size or location is required. X-ray fluorescence (XRF) analyzers are one of elemental analyzers. These analyzers have been used widely because non-destructive and non-preprocessing analysis is possible. However, sample size is limited by sample chamber in general desktop XRF analyzers. On the other hand, handheld XRF analyzers can analyze samples rapidly without this limit, and has come to be recognized from market. HORIBA Ltd. has released MESA-300/330 since 2009, and newly released MESA-600/630 since last year. In this paper, we introduce features and functions about MESA-600/630.

Outline of MESA-600/630

XRF analyzers can perform the qualitative and quantitative analyses of the constituent elements in the sample, by measuring the energy and intensity of fluorescence X-ray emitted from the sample. Handheld XRF analyzers have the following characteristics, and can perform rapid elemental analyses for various samples at any locations.

①High-portability by lightweight and battery driving
②Open X-ray optical system without sample chamber
③Peltier-cooled X-ray detector (Available in few minutes after power-on)
④Optimized measurement methods for sample types

Figure 1 shows overview of MESA-600/630, and Table 1

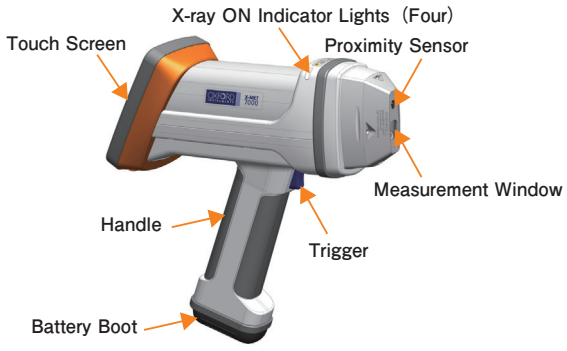


Figure 1 Overview of MESA-600/630

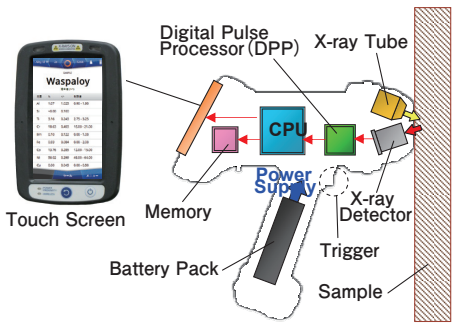


Figure 2 Block Diagram of MESA-600/630

shows specifications of MESA-600/630. Main units included X-ray tube and X-ray detector have inherited those of MESA-300/330. MESA-600/630 has been greatly improved the usability by renewal of user interface and adoption of large screen LCD. Also, this analyzer is possible to use the longer operation time than MESA-300/330 by using the larger-capacity and power-saving battery. We'll introduce the detailed features of MESA-600/630 later.

Table 1 Specifications of MESA-600/630

Contents	MESA-600	MESA-630
Size	90(W)×280(L)×290(H) mm	
Mass	1.8 kg (with battery included)	
X-ray tube	40 kV-50 μA (Target : Rh)	45 kV-50 μA (Target : Rh)
X-ray filter	Fixed	5 positions changed
Detector	Si-PIN (Peltier cooled)	SDD (Peltier cooled)
Elemental Range	K(19)-U(92)	Mg(12)-U(92)
Display	4.3 inches Blanview® LCD	
External Connect	USB, Bluetooth®, Wi-Fi®	
Language	Japanese, English	
Power supply	Li-ion battery pack or AC adapter (110/230 V, 50/60 Hz)	
Calibration Package	Alloy	Alloy, Restricted Materials, Minerals

Measurement Principle

Figure 2 illustrates block diagram of MESA-600/630. The measurement starts after a sample is touched by the measurement window and the trigger is pulled. The excited X-ray from X-ray tube is irradiated to a sample, and the fluorescence X-ray emitted from the sample enters into X-ray detector. Electrical signals from the X-ray detector are processed by digital pulse processor (DPP), then spectrum processing and quantitative calculation are performed by the built-in computer. The calculation is performed once two seconds, and the measurement results are updated automatically.

Features of MESA-600/630

Flexible responses to various usage environments

The weight of this analyzer is light as about 1.8 kg. The touch screen is 4.3 inches Blanview® LCD. As Figure 3 shows, we have performed overall renewal of user interface. Quick settings by using large icons and touch panel operations (Tap, Flick, Scroll etc.) are possible, and the stress-free software operations are realized by high-speed CPU. MESA-600/630 has a large-capacity battery, and the operation time is up to 10 hours. The battery-life of MESA-600/630 is about twice longer than that of MESA-300/330, and the outdoor measurement for a long time is possible. The anti-glare touch screen with good visibility is easy to read even in direct sunlight. Also, IP54 compliant analyzer has the superior protection against dust and water.

High-flexibility measurement calibrations

We can provide three packages for alloy, restricted materials (RoHS/ELV), soil-minerals. Each package has some measurement calibrations, and users can select the most applicable calibration for the sample. There are fundamental parameter (FP) calibrations and empirical calibrations as quantitative analysis. FP calibrations have wide elemental range and are used as general method for many sample types. Empirical calibrations provide higher accuracy as they are used to measure samples with limited elements and limited concentration range. Using the best calibration enables to measure samples in a short time. Also, auto select modes are provided when the operator can't select the appropriate calibration for samples.

High safety for X-ray leakage

MESA-600/630 has five safety protections for the unexpected X-ray leakage.

①Password-lock function

When users start up the analyzer or let stand for 5 minutes with doing nothing, users must input the password. If this lock function isn't released, the emission of X-ray from the analyzer is inhibited.

②Proximity sensor

The sensor is located in the upper part of measurement window to determine whether the sample is present. Unless this is covered by the sample, the emission of X-ray from the analyzer is inhibited even though pulling the trigger.

③X-ray count rate sensor

When the measuring X-ray intensity is very low, this

Figure 3 User Interface of MESA-600/630

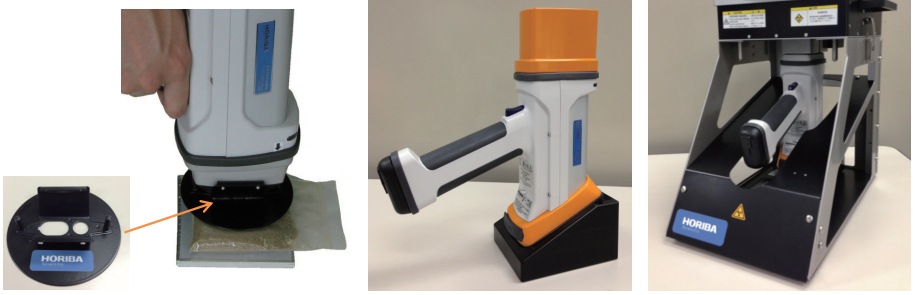


Figure 4 Accessories for Safety Use

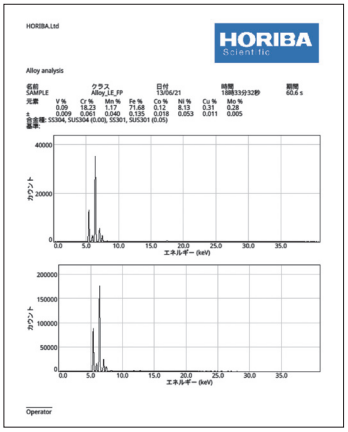


Figure 5 Example of Report Output

sensor determines that there is no sample and the emission of X-ray from the analyzer is inhibited. For example, when the analyzer is separated from the sample during the measurement, it is useful.

④X-ray ON indicator lights

The analyzer has four X-ray ON indicator lights, and these lights flash during the X-ray emitting.

⑤Protection accessories for X-ray leakage

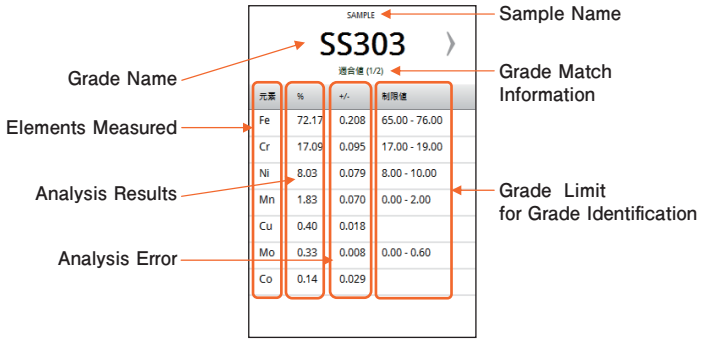
When low-density samples as plastic are measured, the transmission X-ray and the scattering X-ray are stronger than those of metal samples. In that case, we recommend to use the light radiation shield, the light stand and safety shield, the bench-top stand (Figure 4).

Simple data management and output

The analyzer has 16 GB memory, and this memory can be stored the maximum 10 millions data including spectrum. That is equivalent to four years in case of 100 measurements per day and 250 days per year. There are search functions by data names, measurement calibrations, and date. It is possible to browse the stored measurement data from the history screen easily. Connecting the analyzer with PC by USB or Wi-Fi® enables to control it on PC. As shown Figure 5, the PDF output of report is possible by using the report generator.

Applications

The most typical application of handheld XRF analyzer is alloy grade identification. Figure 6 shows analytical results for four stainless steels



Sample：SS303

SAMPLE SS304 適合値 (1/2)

元素	%	+/-	制限値
Fe	70.58	0.219	65.00 - 76.00
Cr	18.55	0.104	18.00 - 20.00
Ni	8.61	0.085	8.00 - 10.00
Mn	1.49	0.071	0.00 - 2.00
Mo	0.43	0.009	0.00 - 0.60
Cu	0.25	0.015	
V	0.10	0.028	

Sample：SS304

SAMPLE SS316 適合値 (1/2)

元素	%	+/-	制限値
Fe	68.35	0.213	60.00 - 73.00
Cr	17.07	0.103	16.00 - 18.00
Ni	10.23	0.092	10.00 - 14.00
Mo	2.16	0.019	2.00 - 3.00
Mn	1.58	0.071	0.00 - 2.00
Cu	0.33	0.017	
Co	0.17	0.030	
V	0.10	0.029	

Sample：SS316

Method：FP Calibration for Alloy
Measurement Time：5 sec.

SAMPLE SS321 適合値 (1/2)

元素	%	+/-	制限値
Fe	69.27	0.215	63.00 - 75.00
Cr	17.68	0.103	17.00 - 19.00
Ni	9.97	0.091	9.00 - 12.00
Mn	1.53	0.071	0.00 - 2.00
Ti	0.46	0.029	0.20 - 0.80
Mo	0.33	0.008	0.00 - 0.60
Cu	0.25	0.016	
Co	0.25	0.032	
V	0.15	0.037	

Sample：SS321

SAMPLE 2024 適合値 (1/2)

元素	%	+/-	制限値
Al	93.65	0.385	90.00 - 96.00
Cu	4.03	0.012	3.80 - 4.90
Mg	1.39	0.267	1.20 - 1.80
Mn	0.52	0.009	0.30 - 0.90
Fe	0.30	0.007	0.00 - 0.50
Zn	0.08	0.002	0.00 - 0.25
Ni	0.03	0.002	

Method：FP Calibration for Alloy
Included Light Elements
Measurement Time：60 sec.

Figure 6 Grade Identification of Stainless Steels

Figure 7 Grade Identification of an Aluminum Alloy

Sample：Minerals

SAMPLE

TEST (5 / 5)

元素	PPM	平均	+/-
Si	396692	392223	8416
Al	50499	51902	5516
K	46140	46504	13135
S	1827	3736	3288
Fe	649	2019	1924
Ca	361	1781	1592
Ag	316	477	148
Rb	296	351	56

Average Results

Figure 8　Average Results of Minerals

(SS303, SS304, SS316, SS321) with 5 seconds measurement time. The display contents are detailed on the result screen of SS303. The identified grade name from alloy grade library which the analyzer has is displayed the upper part of the screen. All stainless steels is identified correctly, and the identification ability are enough even when measurement time is about 5 seconds. Also, MESA-630 can analyze light elements such as Mg, Al, Si. So, the alloy with light element matrix like aluminum alloy can be identified too. Figure 7 shows the analysis results of aluminum alloy 2024. It is generally difficult to detect 1% Mg included in the aluminum alloy, but this analyzer can detect it without vacuum and He purge.

This analyzer has the function of averaging measurement values. Figure 8 shows the analysis results measured a mineral sample at five points. On the result screen, the right half is displayed average values, and the left half is displayed current values. This function is useful when the multipoint measurement is performed for soil and mineral samples which have elemental segregation. On the other hand, users can add or change the setting. For example, users can change the format of result screen, and can set target elements, limit ranges, units, and messages. Figure 9 shows the screening results for hazardous elements in the plastics. The setting is based on RoHS. Because the result screen is color-coded, we can recognize easily that the concentration of measuring elements is within or beyond limit range. Changing the format of result screen enables this analyzer to use as screening device which is suited to various laws and regulations. The analyzer has alloy grade library which is compliant with JIS standard or AISI standard, and users can create additional alloy grade library. Figure 10 shows analysis results of the ring in case using the created alloy grade library for platinum. Even when the analyzer doesn't have

Figure 9　Screening Results of Plastics

alloy grade library, creating the original library enables this analyzer to use as grade identification device for different kinds of alloy. Additionally, there is optional calibration software for creating empirical calibrations. This software can create empirical calibrations the

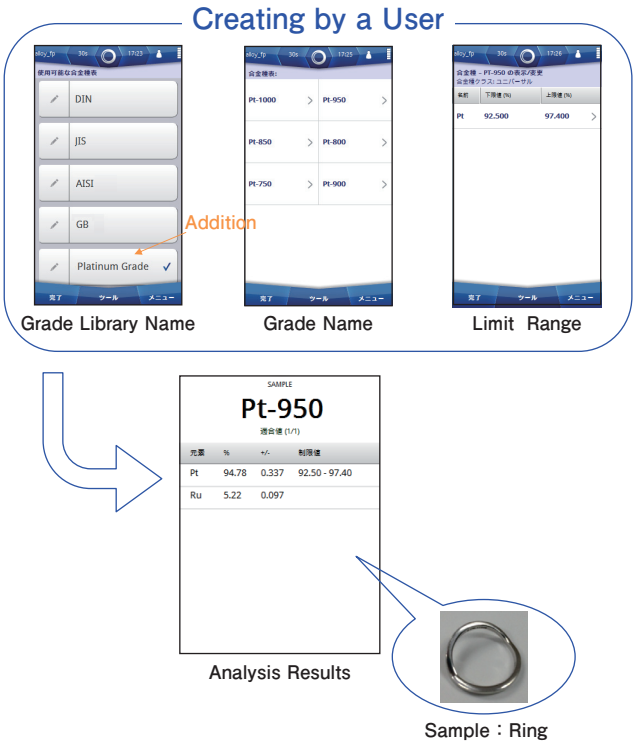


Figure 10　Grade Identification of a Platinum Ring

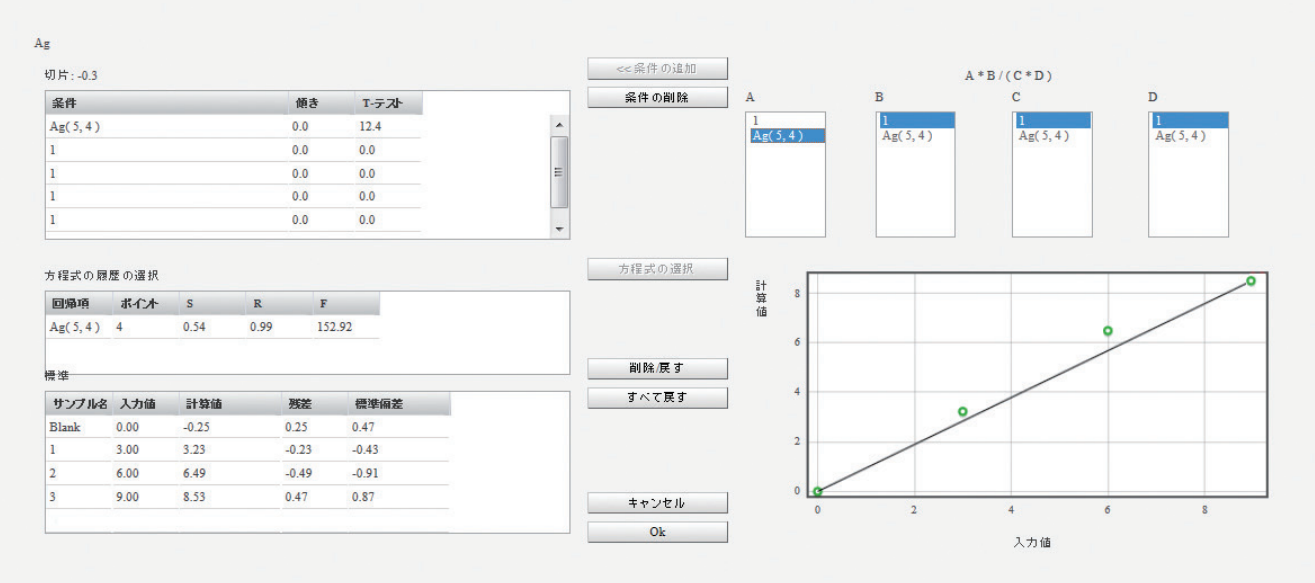


Figure 11 Example of Creating an Empirical Calibration

analyzer doesn't have, and that is useful for measuring special samples. Figure 11 shows a created empirical calibration by three Ag thin films (thicknesses are 3 µm, 6 µm, 9 µm). Additional empirical calibrations using optional software make particular applications such as quality control of special alloy and measurement of plating film thickness.

Conclusion

In this paper, we introduced MESA-600/630 as handheld XRF analyzers. MESA-600/630 is the versatile analyzer to be flexible to various applications. For example, it is very useful for positive material identification (PMI) and metal grade identification because this analyzer has accurate identification ability in a short time. In the future, we will expand the development of new applications which suits user's needs with including measurement know-how and safety.

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