



**Malvern  
Panalytical**  
a spectris company

# EPSILON 1 ACADEMIA

XRF in the hands of scientists



# RESEARCH AND EDUCATION

## Flexible elemental analysis

### Looking for a flexible, yet simple-to-use, analytical instrument for research and education?

The Epsilon 1 X-ray fluorescence spectrometer is an ideal addition to any institution's analytical equipment. It is capable of simple element identification and quantification up to more sophisticated analyses. It can serve to introduce students to an analytical technique widely used in industry for production and quality control, but often neglected in the classroom. If you want to liven up your college and university classes or enhance your serious cutting-edge research, the Epsilon 1 is an easy-to-operate, compact and X-ray safe instrument without the need for additional chemicals.

Epsilon 1 can be used for educating students in lab practicals and for research activities in a variety of disciplines, for example: chemistry, geology, archeology, environmental sciences, material sciences and forensics. Epsilon 1 allows screening and quantification by XRF for an unlimited number of applications for many types of samples. With little to no sample preparation, bulk samples can be quantified across the periodic table.

Epsilon 1's software has the flexibility to perform basic to more sophisticated analyses; such as determinations of layer thickness and composition of metals and coatings. Or carry out cluster analysis based on PCA (Principal Component Analysis) of spectral X-ray fingerprints of a wide variety of materials e.g. drugs, coins, animal feed and much more.

The instrument is pre-calibrated with Omnian, Malvern Panalytical's market-leading standardless analysis package, used on the more advanced instruments. As an out-of-the-box solution Omnian can be used to analyze a wide variety of sample compositions from sodium to americium across the periodic table.

Malvern Panalytical has a strong reputation for safe and high-end X-ray instrumentation. Epsilon 1 is built using our market-leading technology with superior quality, worldwide service and application support. Application training courses and expertise are available on request.

## THE TOTAL SOLUTION CONSISTS OF

- An Epsilon 1 XRF instrument with flexible user software
- Factory pre-calibration for Omnian standardless analysis
- A validation sample
- A starting kit for preparing the first 100 liquid cups for liquid and loose powder analysis



Sample preparation foils



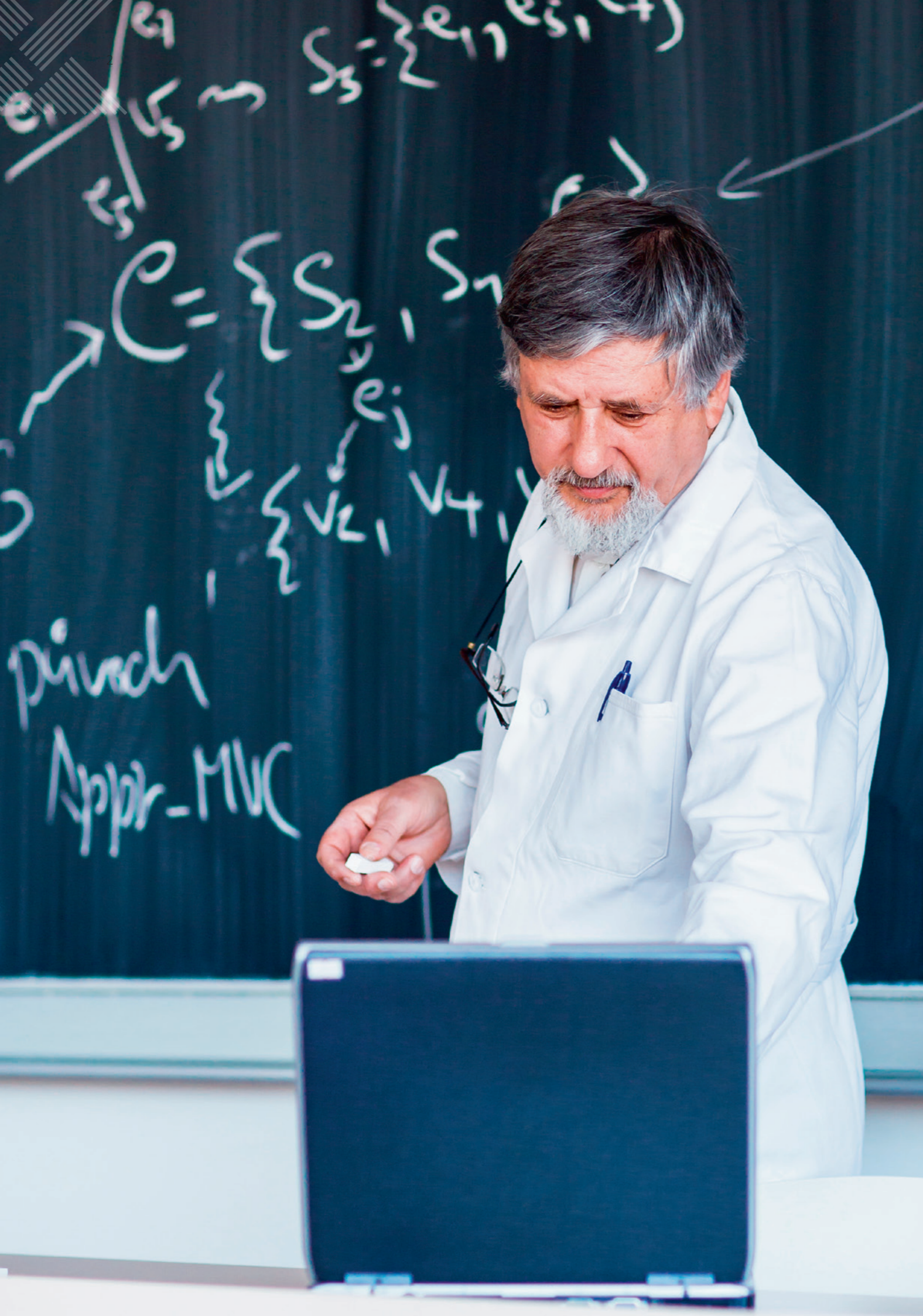
Preparation tool



Liquid cups



Validation sample



## READY FOR ANY SAMPLE

### Easy sample preparation

Epsilon 1 can handle a large variety of sample types, weighing a few 100 milligrams, to larger bulk samples: solids, pressed powders, loose powders, liquids, fused beads, slurries, granules, films and coatings. Also large and irregularly shaped objects with maximum dimensions of 15 x 12 x 10 cm (W x D x H) can be analyzed.



Liquids, loose powders and solids

### Simple to operate



Place your sample for measurement.



Enter sample name and push 'measure' button.

## CONVENIENT RESULTS VIEWING



### MEASURE IN YOUR OWN LANGUAGE

Ten most common languages are available for the operator:

測量  
Measure  
測定  
Mesurer  
Messung  
Mesure  
Zmierzyć  
Medida  
Измерить  
Médír

## CLOSE-UPS

The Epsilon 1 is a fully integrated energy dispersive XRF analyzer consisting of a spectrometer, built-in computer and analysis software. Powered by the latest advances in excitation and detection technology, the Epsilon 1 is a star performer in the low-cost benchtop instrument class. A well-designed optical path, a wide range of excitation capabilities ranging from 7 to 50 kV for light and heavier elements and a highly sensitive SDD detector system contribute to the Epsilon 1's uniqueness.

### Self-contained system

Built-in computer running Microsoft Windows 10 with a powerful CPU and 120 GB hard drive ensures flexibility to store and handle thousands of results.

### Repeatability for years

A low-drift X-ray tube and a handy drift correction routine give compliant results for years without the need for time-consuming re-calibration.

### Maximum sensitivity

The thin-window Ag anode X-ray tube, designed and manufactured by Malvern Panalytical, ensures high quality and sensitivity. The selection of Ag anode material is ideal for the accurate quantification of P, S and Cl without interference of possible line overlaps in the XRF spectrum, leading to more reliable results. The 50 kV X-ray tube and generator are ideal for exciting heavier elements, resulting in faster analysis times.

### Spillage protection

In order to shield the delicate heart of the system from spillage, a protection foil is in place. In case of spillage, the foil can be replaced easily by the operator.

### Economical footprint

Compact design with a built-in computer and touchscreen reduces the requirement of valuable lab space to less than 0.15 m<sup>2</sup>.

### Easy operation

High-resolution (1024 x 768), 10.4" LCD touchscreen for easy walk-up and operation.

### Liven up your lectures

USB and network connections for use of standard computer peripherals enable extended use, application development, seated operator or overhead projection during lectures.

### Best accuracy

Highly concentrated samples can cause detector saturation resulting in lower accuracy or longer measuring times. Epsilon 1 uses the latest in silicon drift technology in combination with the fastest electronics (1.5Mcps @ 50% dead time) to handle these highly concentrated samples without any loss of accuracy or increased measuring times.

### Atmospheric variations

Low-energy X-ray photons characteristic of sodium, magnesium, aluminium, silicon, phosphorus and sulfur are sensitive to air-pressure and temperature variations. Built-in temperature and air-pressure sensors compensate for these atmospheric variations, ensuring excellent results whatever the weather.

### Sample positioning

Highly repeatable sample positioning reduces sample-to-sample variations.

### Safety guaranteed

Epsilon 1 complies with the latest Machinery Directive, CSA, IEC, EMC, Vollschutz norms and standards for protection and radiation safety to guarantee a safe instrument for the operator.

## ADVANTAGES OF XRF

- Unmatched analytical precision and accuracy compared to other analytical techniques
- Quick quantification method
- Simple, fast and safe sample preparation
- Non-destructive analysis
- Wide analytical concentration range (ppm – %) reducing the necessity for dilution and associated errors

Z		Possible to analyze with Epsilon 1																Z																																																																																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100





## ROBUST AND FLEXIBLE QUANTIFICATION OF ANY SAMPLE

For characterization and analysis of samples where the composition is unknown, or in situations where certified standards that match specific sample characteristics are not available, Malvern Panalytical's Omnia package is an ideal solution.

Important applications include sample quantification, screening, failure analysis, troubleshooting, as well as the comparison of different materials. The following data show some representative results obtained using Epsilon 1 with Omnia standardless analysis.

### Low alloy steel

- SS 402 standard
- Iron (Fe) as balance

SS 402		
Element	Certified conc. (wt %)	Measured conc. (wt %)
Si	0.27	0.29
P	0.006	0.007
S	0.023	0.040
V	0.22	0.23
Cr	0.55	0.58
Mn	0.19	0.23
Ni	0.73	0.74
Cu	0.23	0.23
Mo	0.16	0.15

### Polyethylene

- 4 mm thick NIST 2855 level II standard
- CH<sub>2</sub> as balance

NIST 2855 level II		
Element	Certified conc. (ppm)	Measured conc. (ppm)
Si	186.7	215.2
P	22.0	17.1
S	21.0	21.7
Ca	37.6	34.2
Ti	10.4	10.2
Cr	2.4	4.4
Zn	415	466.7

### Pharmaceutical excipient

- Cellulose standard, prepared as 5 g pressed pellet
- C<sub>6</sub>H<sub>10</sub>O<sub>5</sub> as balance

PharmaCAT PGM-QC		
Element	Certified conc. (ppm)	Measured conc. (ppm)
Ru	50	50
Rh	50	48
Pd	50	49
Ir	50	59
Pt	50	58

## OMNIAN ADVANTAGES

### The right result every time

- Advanced technology for robust results
- Precise results for almost any sample using the default setup
- Accuracy and detection enhancement with ASC and selected peak measurements

### Easy to use

- Scalable from routine to advanced usage
- Easy data retrieval

### Problem solving power for your analytical challenges

- Quantitative analysis
- Batch and materials control
- Quick screening
- R&D analysis tool
- Failure analysis
- Comparative analysis

# ENHANCE YOUR RESEARCH

The Epsilon 1 software consists of two user levels with explicit functionality:

1. Operation mode - for simple operation and convenient results viewing
2. Advanced mode - for full flexibility and access to all features in the software. In this software mode, an unlimited number of applications can be created.

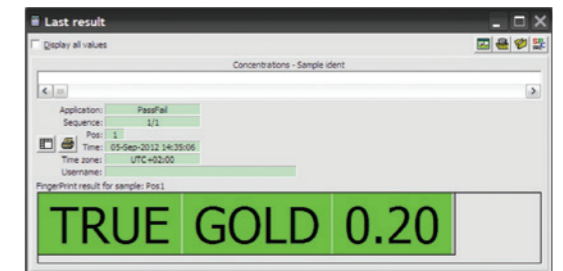
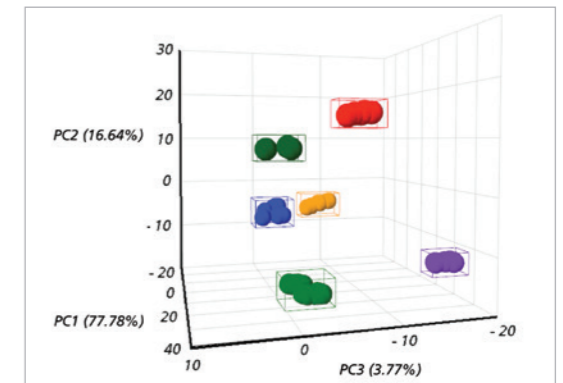
Two software options are available to further enhance the capabilities of Epsilon 1: FingerPrint and Stratos modules.

## Pass/Fail analysis FINGERPRINT

The FingerPrint option is available for material characterization and PASS/FAIL analysis. It is ideal for material testing when analysis speed is important but the actual composition is not of interest.

FingerPrint generally involves little to no sample preparation and the unknown sample is compared against a library of standards or other in-house samples. Then the closest match is reported with a level of uncertainty. Principal components analysis (PCA) in combination with cluster analysis are powerful tools to investigate materials by setting up automated fingerprinting applications. With this tool also 3D graphical visualization of the data set is possible.

Advanced algorithms perform all the hard work. PASS/FAIL criteria can be set up according to different approaches that give flexibility in tailoring a fingerprinting method.



## Multi-layer analysis STRATOS

The Stratos module features an algorithm which enables simultaneous determination of chemical composition and thickness of layered materials. The software provides a rapid, simple and non-destructive means of analyzing coatings, surface layers and multi-layered structures.

Accurate results are achieved by using conventional bulk standards, or reference samples whose composition and layer structure differ from those of the unknowns.

This solves one of the biggest issues of multi-layer analysis: acquiring expensive certified multi-layer standards that match the production samples.

Moreover, accuracy can be further improved by adding in-type standards to the main calibration by using Adaptive Sample Characterization (ASC).

The Virtual Analyst in the software can model the fluorescent response of the sample based on a nominal sample definition and gives the optimal settings for analysis.





## WHY CHOOSE MALVERN PANALYTICAL?

We are global leaders in materials characterization, creating superior, customer-focused solutions and services which supply tangible economic impact through chemical, physical and structural analysis.

Our aim is to help you develop better quality products and get them to market faster. Our solutions support excellence in research, and help maximize productivity and process efficiency.

Malvern Panalytical is part of Spectris, the productivity-enhancing instrumentation and controls company.  
[www.spectris.com](http://www.spectris.com)

## SERVICE & SUPPORT

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
- Compliance and validation support
- Onsite or classroom-based training courses
- e-Learning training courses and web seminars
- Sample and application consultancy



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