



Runs On Air.

AGILENT 4100 MICROWAVE PLASMA-  
ATOMIC EMISSION SPECTROMETER

The Measure of Confidence



**Agilent Technologies**

# runs on air



## AGILENT 4100 MP-AES

Agilent Technologies introduces the most significant advance in atomic spectroscopy in decades — the Agilent 4100 Microwave Plasma-Atomic Emission Spectrometer.

**The Agilent 4100 MP-AES doesn't just redefine a category — it creates a new one.**

Say goodbye to flammable and expensive gases. Say hello to enhanced productivity. The safer, cost efficient Agilent 4100 MP-AES has higher sensitivity with detection limits down to sub ppb levels, speed that goes beyond flame Atomic Absorption, and no combustible gases. Best of all, the revolutionary Agilent 4100 MP-AES runs on air.

The Agilent 4100 MP-AES delivers:

- Lowest cost of ownership — the Agilent 4100 MP-AES runs unattended without flammable or expensive gas supply, dramatically reducing your operating costs
- High-performance — magnetically excited microwave plasma source provides superior detection limits to flame AA
- Ease of use — application-specific software applets plus plug-and-play hardware ensure any user can set up quickly without method development or alignment, and with minimal training
- Improved laboratory safety — in addition to eliminating flammable and oxidizing gases, the 4100 MP-AES eliminates the need to plumb multiple gases into the laboratory, or manually transport and handle gas cylinders
- Robustness and reliability — ideal for industries such as mining, food and agriculture, chemicals, petrochemicals, and manufacturing, and for remote locations



Resource conservation protocols save time and gas... and can even help save the environment.

The Agilent 4100 MP-AES eliminates combustible gas usage, gas transportation, and standby power consumption. So you can use less gas and electricity, and help conserve our natural resources.

## Atomic Spectroscopy Milestones

<b>1957</b> Built components for world's first AA (as Techtron)	<b>1971</b> Applies for a patent on Zeeman background correction	<b>1977</b> Automated graphite furnace AA with the ASD-53, the first furnace autosampler	<b>1985</b> SpectrAA instruments released with central instrument control	<b>1987</b> Introduction of the first computer controlled ICP-MS, the PMS 100	<b>1991</b> Releases first sequential ICP-OES	<b>1994</b> Launch of the 4500 Series, the world's first benchtop ICP-MS
<b>1997</b> Fast Sequential AA reduces analysis times by up to 50%	<b>1998</b> Releases first simultaneous ICP-OES with full wavelength coverage	<b>2004</b> Introduction of 200 Series AA and GTA120 GFAA with extended tube life	<b>2006</b> Launch of the 700 Series ICP-OES — world's fastest ICP-OES	<b>2009</b> Launch of the Agilent 7700 Series ICP-MS featuring Agilent's HMI and ORS <sup>3</sup> Cell	<b>2010</b> Varian becomes part of Agilent	<b>2011</b> Agilent redefines elemental analysis with the introduction of the Agilent 4100 MP-AES

# FOR YOUR APPLICATION

Agilent is committed to providing solutions for your application. We have the technology, platforms, and expert guidance you need to be successful.



### GEOCHEMICAL

Common applications for the Agilent 4100 MP-AES

- Geochem samples in aqua regia digests
- Trace elements in geological samples
- Trace level gold in cyanide leach
- Analysis of high purity gold
- Platinum group elements in ore grade material
- Various elements in plating solutions



### CHEMICAL & PETROCHEMICAL

- Additives in lubricating oils
- Wear metal contaminants in used oils
- Analysis of coolant
- Analysis of petroleum and diesel fuel
- Major elements in polymers



### FOOD & AGRICULTURE

- Major elements in foods, beverages and agricultural samples
- Cations in soils
- Nutrients in soils
- Metals in soil extracts
- Metals in agricultural soil samples



### ENVIRONMENTAL

- Hg, Pb, Cd and Cr in electronics and plastics (for WEEE/RoHs compliance)
- Heavy metals in soils
- As, Sb and Se in sediments and waste
- Analysis of waste waters, sediments and soils

# efficient



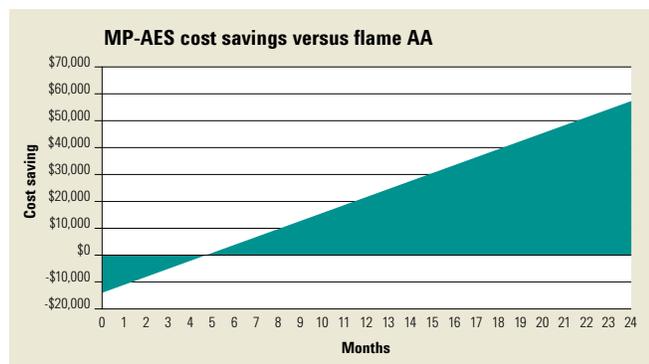
## JOIN THE REVOLUTION

The Agilent 4100 MP-AES offers safe, sensitive, unattended analysis without the need for flammable or expensive gases.

### Lowest cost of ownership

Do you know how much you spend on instrument grade gases each year? Probably much more than you think. Because the Agilent 4100 MP-AES runs using only air it improves safety, vastly reduces cost of ownership, and eliminates the need for ongoing supply of flammable or expensive gases.

- Using the Agilent 4107 Nitrogen Generator, nitrogen is extracted from the air to provide a continuous nitrogen supply for plasma operation



### Saving you money

Replacing your flame AA with an Agilent 4100 MP-AES can realize significant savings. For example, for analysis of nine elements in 100 samples measured three days/week, savings start within five months. After 18 months, you'll save\* over \$40,000 in operating costs!

\* Savings may vary depending on factors including local gas costs, number and type of elements, etc.

- Increase sample throughput with safe, reliable, unattended multi-element analysis
- Eliminate hollow cathode lamps, deuterium lamps for background correction, and burner blockage
- Eliminate standby operating costs. When the Agilent 4100 MP-AES is off, no gas or power is used. Simply switch it on again when needed for analysis.

### High performance for difficult samples

- Robust, magnetically excited microwave plasma source handles difficult matrices with ease, including high solids, fuels and organics
- The Agilent 4100 MP-AES produces sensitivity, linear dynamic range, detection limits and analysis speed superior to flame AA
- Innovative torch design is vertically positioned for best performance with difficult samples, and features end-on axial viewing for excellent detection limits

**Lowest cost of ownership, higher throughput, improved laboratory safety and lower detection limits — can you afford not to switch to the Agilent 4100 MP-AES?**

# HOW IT WORKS

The excitation source of the Agilent 4100 MP-AES is unique — a magnetically excited microwave plasma.

At the heart of this plasma generation system is a robust and reliable industrial magnetron — technology long proven in millions of microwave ovens around the world. By using the magnetic field rather than the electric field to couple the microwave energy into the plasma, the Agilent 4100 MP-AES produces a robust plasma — capable of handling your toughest samples with ease.

Light emission from the plasma is directed to a wide range, low noise charge coupled device (CCD) detector — measuring spectra and background simultaneously while providing excellent detection limits and precision.

## **Enhanced stability and precision**

*Solid state CCD detector provides simultaneous background or interference correction.*

## **Simple installation**

*The air cooled design and conventional power supply make field or laboratory installations easy.*

## **Plug-and-play hardware**

*Torch loader eliminates time consuming torch alignment and gas connections, getting you up and running fast.*

## **Lowest cost of ownership**

*The nitrogen generator eliminates on-going gas requirements, dramatically reducing operating costs.*

## **Safe and efficient**

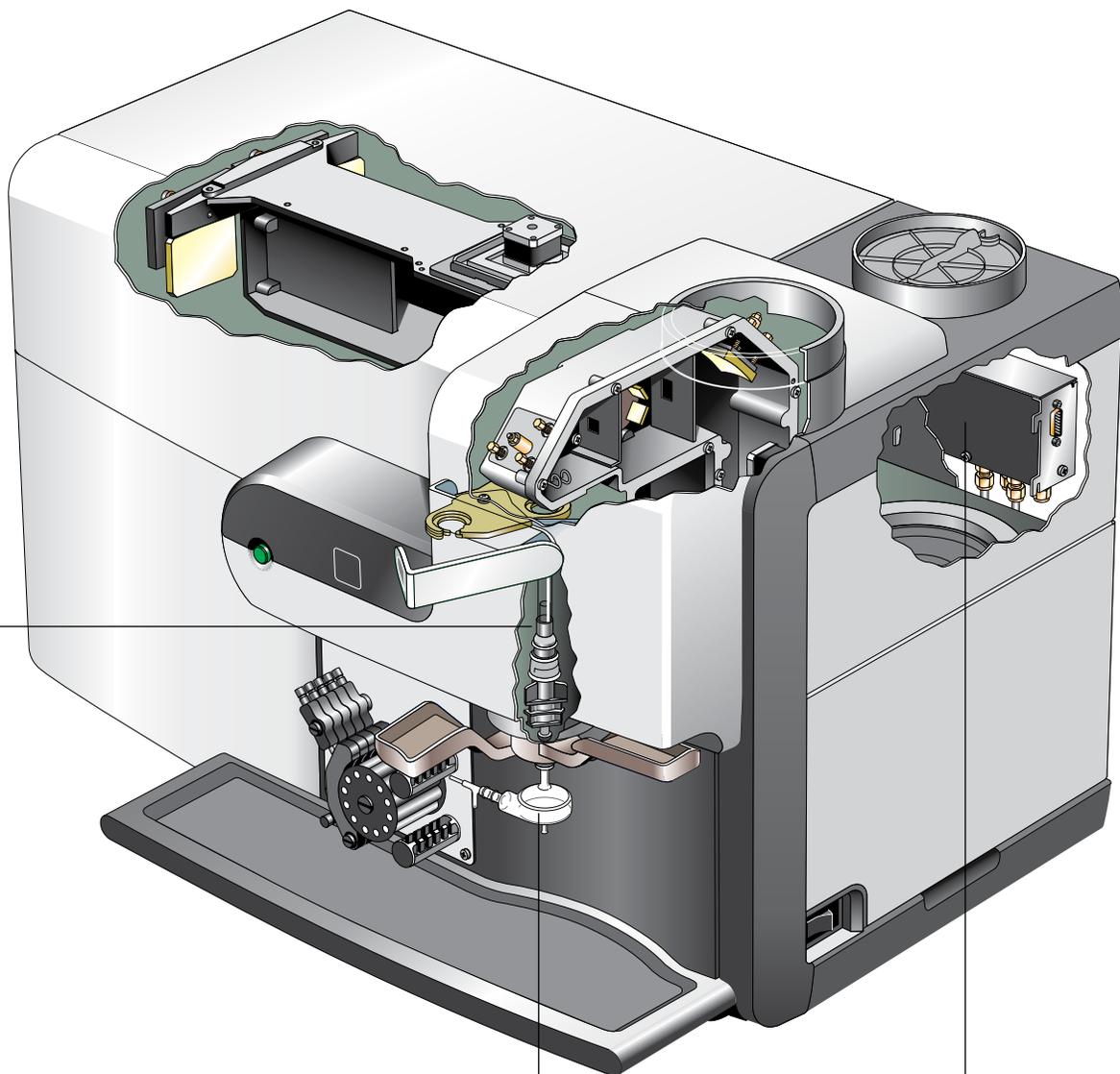
*By running on air, the Agilent 4100 MP-AES eliminates flammable or oxidizing gases and the safety concerns of gas handling in your lab.*

## **Versatile**

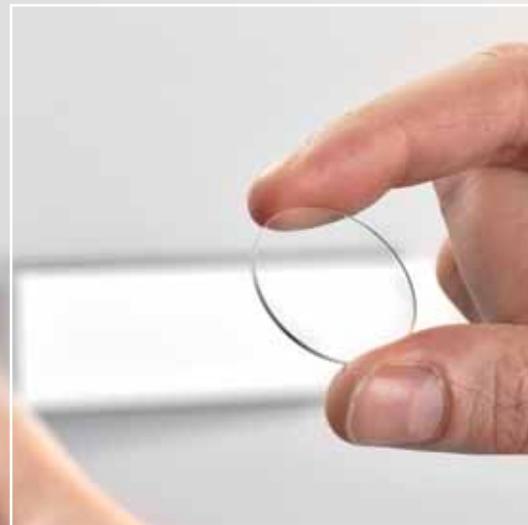
*The standard spray chamber and concentric nebulizer handle everyday samples. For organics or high TDS samples, use the double pass spray chamber and OneNeb nebulizer. For HF and strong acids, use the inert spray chamber and OneNeb nebulizer.*

## **Organic capabilities**

*Analyze organic samples quickly and efficiently using the external gas control module (EGCM), which injects air into the plasma, eliminating carbon buildup and reducing background.*



# intuitive



## REDEFINING ELEMENTAL ANALYSIS

The Agilent 4100 MP-AES makes at-site analysis a reality. With rugged, reliable hardware and intuitive software, any user can quickly become an expert.

### Fast and easy to use

- Easy-to-use, application-specific software applets automatically load a pre-set method so you can start analysis immediately without method development or alignment, and with minimal training
- Reliable torch loader automatically aligns the torch and connects gases for fast start up and reproducible performance
- Easy access to sample introduction components aid routine maintenance and troubleshooting, minimizing downtime
- Flexible correction options provide simultaneous background or interference correction in real time for accurate and precise results

### Safety you can rely on

- No expensive flammable or oxidizing gases, and no danger of flammable gas leaks
- No need to plumb multiple gases into the laboratory, making it ideal for remote locations such as mine sites or environmental monitoring stations
- No need to order, connect or replace cylinders, reducing your ongoing operating and servicing costs
- No transport or manual cylinder handling risks, and no risk of frozen regulators in cold climates
- No greenhouse gas emissions —the Agilent 4100 MP-AES has zero fuel-based carbon emissions

### Torch installation in three easy steps



# REMARKABLY BETTER SOFTWARE

Application-specific software simplifies your workflow.

With a familiar worksheet interface, automated method development, and software applets that include pre-set method templates, the Agilent MP Expert software saves you time.

- Wavelength and optimum parameters are preset and automatically recalled as you select the elements you need
- To avoid documented interferences, the comprehensive spectral library highlights potential interferences as you select each wavelength
- Results are clearly displayed on screen, with large format number results for the current sample enabling easy tracking, even across a busy laboratory
- The instrument status display provides a comprehensive overview of current status and diagnostics for easy trouble shooting, if required
- Recall and review previously stored data at any time, even while an analysis is in progress
- Quality control standards can be easily included to verify and confirm results during analysis
- Easily transfer results to a LIMS or other application using the flexible data exporting options
- MP Expert software is available in your choice of nine languages, so anybody can be confident running the system

## Three steps to analysis

**1** Click the icon. The applet automatically loads the pre-set method



Agriculture



Beverages



Chemicals



Energy



Food



Fuels



Industrial



Metals

**2** Enter sample labels, sample type, and weight/volume correction factors

Type	Sample Label	Au 267.595 nm	Au 267.595 nm
1	Blank	0.000	0.000
2	Standard 1	0.000	0.000
3	Standard 2	0.000	1.000
4	Standard 3	10.000	10.000
5	Standard 4	20.000	20.000
6	Standard 5	10.000	40.000
7	Blank 105.4A	0.001u	0.001u
8	Blank 105.4A	0.002u	0.002u
9	0.10ppm	0.000	0.000
10	0.10ppm	0.001	0.000
11	1.0ppm	0.000	1.000
12	1.0ppm	0.002	1.000
13	10.0ppm	0.000	10.000
14	10.0ppm	0.000	10.000
15	10.0ppm	0.200	10.000
16	10.0ppm	0.200	10.000
17	10.0ppm	10.000	10.000
18	10.0ppm	10.000	10.000
19	10.0ppm	10.000	10.000
20	10.0ppm	10.000	10.000
21	10.0ppm	10.000	10.000

Results Panel:

**Au**  
267.595 nm  
7.074 ppm  
%RSD: 0.39  
7.0 ppm (15)

**3** Load samples and run the analysis

Plasma Pump Run Stop MP Expert Instrument

# robust

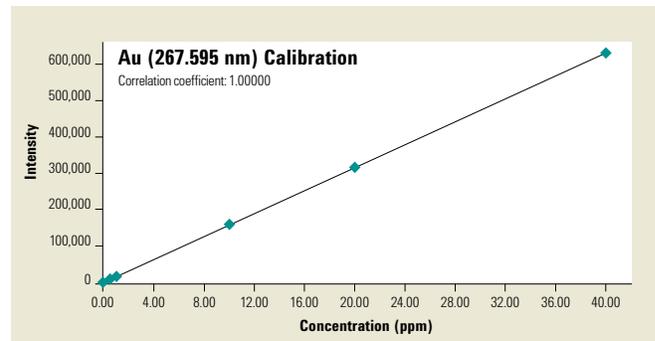


## GEOCHEMICAL APPLICATIONS

Revolutionize the way you do your business. With no gas connections required, and no ongoing-gas requirements, you can locate the Agilent 4100 MP-AES where your samples are.

With no flammable gases and no cylinder handling hazards, the Agilent 4100 MP-AES is ideal for remote field placement.

- Slash your operating costs — replacing your flame AA with the Agilent 4100 MP-AES can pay for itself in a matter of months, based on gas savings alone
- Improve your productivity — with no need for ongoing gas supply, remote sites and mobile laboratories will never again have to deal with the issue of sourcing gas, or having gas delivered to a remote location
- Accuracy even with difficult samples — radial plasma torch provides excellent performance for tough samples with axial viewing for the best sensitivity
- No need for dilutions — analyze major and minor components in the same analysis using the Multical feature
- Sample introduction components are designed to tolerate the strongest acid matrices
- Low flow sample delivery option is ideal for low volume and precious samples



### **Accurate and precise gold analysis**

*With better performance than flame AA, the 4100 MP-AES provides low ppb detection limits for gold. Shown is the excellent precision, extended range, and superb linearity, even in the most difficult geological matrices.*



**Automate your analysis with the SPS 3**

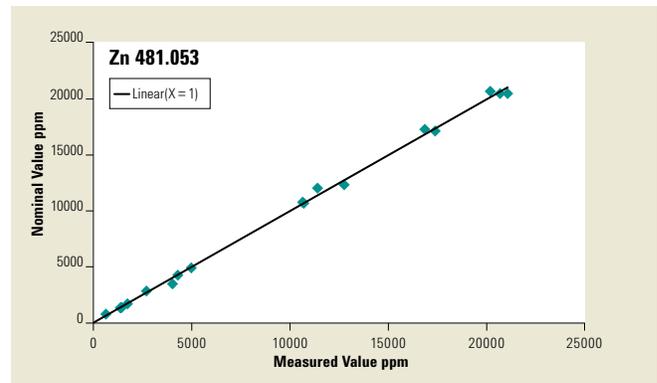
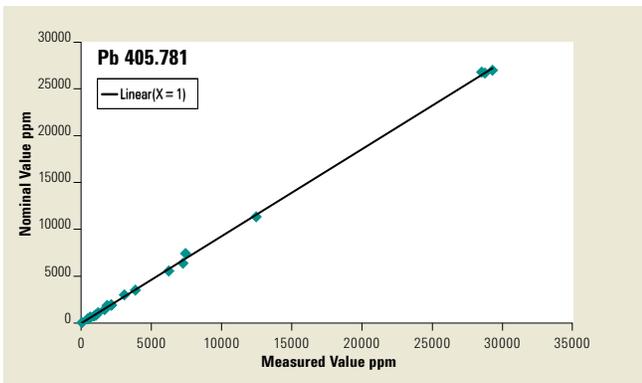
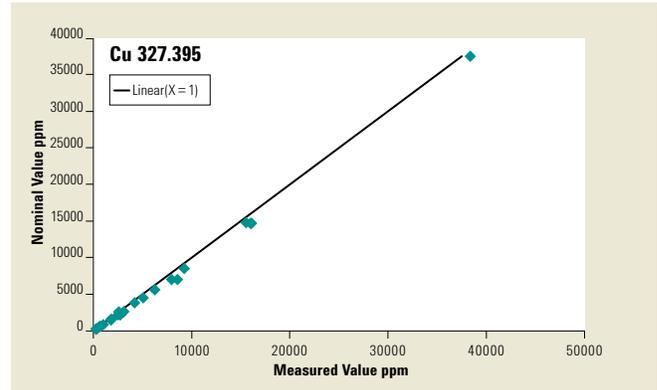
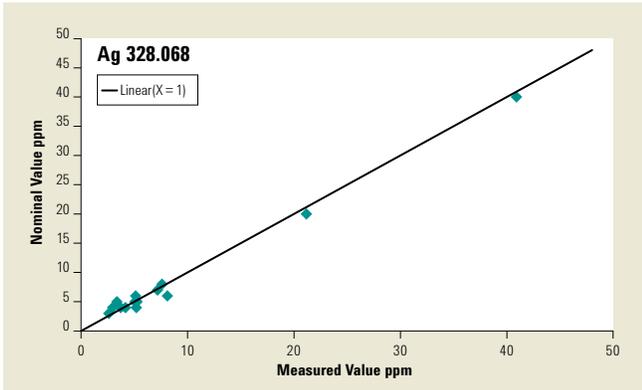
Use the Agilent SPS 3 Sample Preparation System to further automate and simplify your analysis. With the fastest operation, extended sample capacity via rack changes, and a flexible choice of racks, simply load, set and go.



**OneNeb universal nebulizer for challenging samples**

The inert plastic construction of the Agilent OneNeb Universal Nebulizer is resistant to organic solvents and strong acids, while the virtually unblockable design makes it ideal for samples containing high dissolved solids.

# GEOCHEMICAL APPLICATIONS



**Excellent results with difficult metals analysis**

Shown is the performance of the Agilent 4100 MP-AES for base metals in ore grade samples, demonstrating excellent correlation from low to high levels.

To learn more about the Agilent 4100 MP-AES, visit [www.agilent.com/chem/RunsOnAir](http://www.agilent.com/chem/RunsOnAir)

# reliable



## FOOD AND AGRICULTURE APPLICATIONS

With high sample throughput and fast sequential measurement, the Agilent 4100 MP-AES will ensure you provide food, beverages and agricultural products of consistent quality and uncompromising safety.

The Agilent 4100 MP-AES is ideal for contract laboratories where fast turn around is key, including small to mid-sized screening laboratories needing to determine essential nutrients and elements at major levels, and toxic elements at trace levels.

- With the lowest cost of ownership, the Agilent 4100 MP-AES will give you the edge over your competition by reducing your cost per analysis and improving performance
- Eliminate downtime waiting for gas refills, and achieve fast sample turn around with safe, reliable unattended analysis
- Reduce sample preparation. The axially viewed vertical plasma handles your toughest samples — from food and soil digests to high salt soil extractions
- Achieve more than twice the sample throughput of conventional flame AA systems
- Rapid method development and fast start-up means any user can achieve optimum performance
- Use the MultiCal feature in MP Expert software to analyze elements at high and low levels in the same analysis
- Complete wavelength coverage means you can avoid spectral interferences from majors by simply choosing another wavelength

Certified Reference Material		Ca (%)	Mg (%)	K (%)	Cu (mg/kg)	Fe (mg/kg)	Zn (mg/kg)
<b>NIES No 7 Tea Leaves</b>	Certified Value	0.320 ± 0.012	0.153 ± 0.006	1.86 ± 0.07	7 ± 0.3	–	33 ± 3
	Measured Value	0.314 ± 0.013	0.150 ± 0.004	1.86 ± 0.07	7 ± 0.8	–	34 ± 3
<b>NIES No. 10c Rice Flour</b>	Certified Value	0.0095±0.0002	0.125 ± 0.008	0.275 ± 0.010	4.1 ± 0.3	11.4 ± 0.8	23.1 ± 0.8
	Measured Value	0.0095±0.0007	0.127 ± 0.006	0.279 ± 0.012	4.0 ± 0.3	10.6 ± 0.2	21.8 ± 1.0
<b>NIST 1577 Bovine Liver</b>	Certified Value	0.0124±0.0006	0.0604± 0.009	0.97 ± 0.06	193 ± 10	270 ± 20	130 ± 13
	Measured Value	0.0131±0.001	0.0625±0.0045	1.00 ± 0.08	185 ± 6	266 ± 5	125 ± 4

### Wide dynamic range for agriculture applications

Results from analysis of acid extractable minor and major elements in agriculture samples demonstrate the wide dynamic range and accuracy of the Agilent 4100 MP-AES.



#### Simple installation

The Multimode Sample Introduction System (MSIS) is easy to plumb, install and operate.

#### Simplify vapor generation with the MSIS

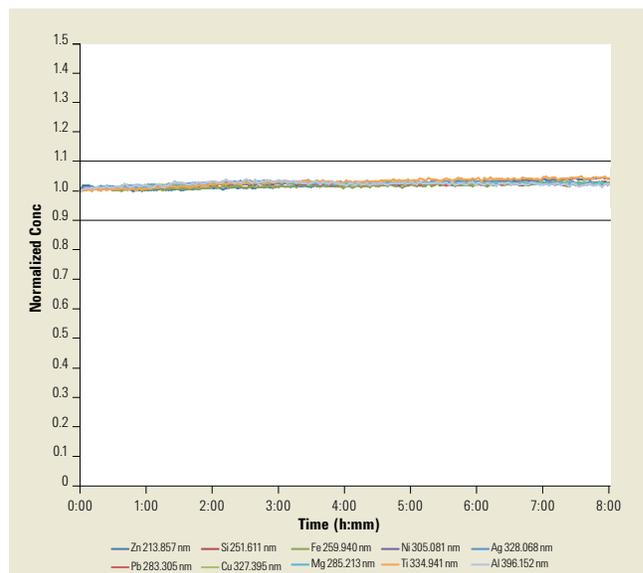
- Optional MSIS provides simultaneous vapor generation of environmentally sensitive elements including As, Se and Hg with low ppb detection limits
- High performance — the MSIS uses thin film hydride technology for significantly better performance than conventional nebulization
- Save time — determine hydride elements at the same time as your routine elements
- Eliminate changeover — with a choice of three modes (conventional aspiration, hydride only or simultaneous hydride and conventional aspiration), routine elements can be determined using the same setup as hydride elements

# CHEMICAL AND PETROCHEMICAL APPLICATIONS

Production demands and efficiency improvements impose increasingly tough demands on your business. Use the rugged and reliable Agilent 4100 MP-AES to provide fast, accurate results for difficult samples.

With the lowest cost of ownership and improved ease of use, the reliable Agilent 4100 MP-AES is ideal for challenging samples — from volatile organic solvents to used engine oils.

- Vertically oriented torch minimizes blockages, improving long term stability and reducing downtime
- Set up is easy — just plug in the External Gas Control Module (EGCM). No special torch or plasma settings are required
- EGCM injects air into the plasma, preventing carbon build up and reducing background
- Air injection rate is software controlled, and can be changed as you switch between different elements in the sample
- Rapid method development — auto-optimization enables you to select the optimum settings for each wavelength
- Perform sulfur determinations using a nitrogen purge of the optics



#### Excellent long term stability

Shown is an organics solution (ShellSol) achieving <2% RSD repeatability for all elements over 8 hours, using the Agilent 4100 MP-AES with the OneNeb nebulizer.

## Trust Agilent to keep your lab running — at peak productivity

Agilent's Advantage Service protects your investment in Agilent instruments and connects you with our global network of experienced professionals who can help you get the highest performance from every system in your lab. Count on us for the services you need at every stage of your instrument's lifecycle — from installation and upgrade to operation, maintenance and repair.

For customers who require full system validation, Agilent offers complete qualification services (Installation and Operational Qualification) for the Agilent 4100 MP-AES hardware, software and accessories.



And if ever your Agilent instrument requires service while covered by an Agilent service agreement, we guarantee repair or we will replace your instrument for free. No other manufacturer or service provider offers this level of commitment.

## Further information

For full details of the Agilent range of atomic spectroscopy products, ask for a brochure or visit our website at [www.agilent.com/chem/atomic](http://www.agilent.com/chem/atomic)

Agilent 7700 Series ICP-MS offers unmatched matrix tolerance and interference removal, and the smallest footprint of any ICP-MS.



Agilent 700 Series ICP-OES is the world's most productive high performance simultaneous ICP-OES.



Agilent's AA range includes the world's fastest flame AA and the world's most sensitive furnace AA.



### Maximize your productivity and data quality with genuine Agilent parts and supplies

From our proprietary integrated torch design to our sample introduction components — Agilent 4100 MP-AES parts and supplies are manufactured to stringent specifications and are rigorously tested to ensure that you'll always get the best performance.

### Our catalog of new applications is ever growing.

To learn about the latest, contact your local Agilent Representative or visit us at: [www.agilent.com/chem](http://www.agilent.com/chem)

### Find out how Agilent's Atomic Spectroscopy Solutions can deliver the performance, accuracy and flexibility you need.

Learn more: [www.agilent.com/chem](http://www.agilent.com/chem)

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