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The Measure of Confidence

Agilent Technologies

Latest Revision of ICP-MS MassHunter Software for the Agilent 7700 Series ICP-MS and 8800 ICP-QQQ

Ed McCurdy
Agilent Technologies

ICP-MS MassHunter software has been updated for the 7700 Series and 8800 ICP-QQQ, providing many new features and improved operation in key application areas.

Agilent's ICP-MS MassHunter software has been supplied with the 7700 Series ICP-MS since 2009, with major updates in 2010 and 2011 (see Journal issues #43 and #48). A further release (G7201B, rev.B.01.01) in early 2012 saw the migration of ICP-MS MassHunter to Windows 7 64bit operating system, and added support for the 8800 ICP-QQQ and direct control of Agilent Cap-LC and Themostatted Column Compartment (TCC) modules.

The latest B.01.02 revision (released December 2012) adds more new functions, performance improvements and a range of other enhancements.

MassHunter B.01.02 Key Features

The major developments in the new revision are:

- Improved functionality for fast TRA and laser ablation
- More flexible tuning options for non-standard applications
- Additional data processing functions for chromatography
- Compatible with Agilent Spectroscopy Database Administrator (SDA) for Compliance in regulated pharma laboratories

New Feature Overview for G7201B, revisions B.01.01 and B.01.02

Support for 8800 ICP-QQQ

In early 2012, Agilent released the innovative and unique 8800 Triple Quadrupole ICP-MS.

In addition to the updates in software functions required to control the QQQ hardware, MassHunter also provides support for the advanced acquisition and data processing modes available with MS/MS (precursor and product ion scan, and mass shift mode).

The instrument type selection dialog and hardware control pane for the 8800 are shown in Figure 1.

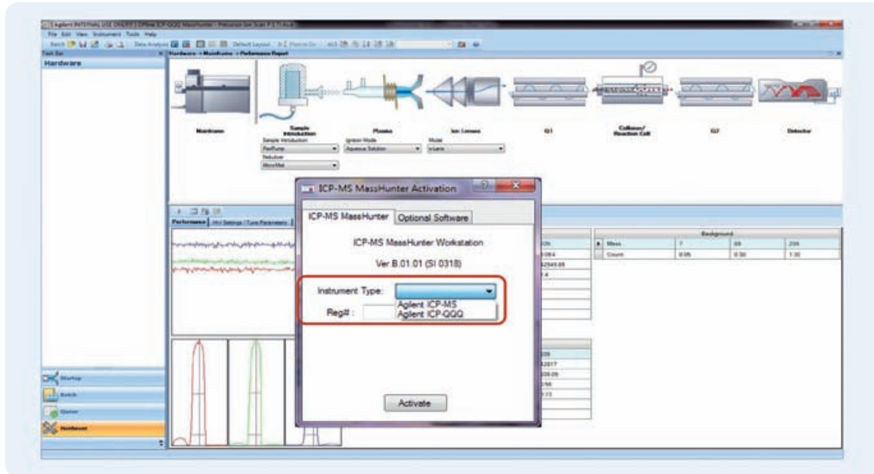


Figure 1. 8800 ICP-QQQ hardware

Fast TRA Acquisition

The 7700 (and its predecessor the 7500 Series) has always been at the forefront of detector technology, with fast acquisition (minimum dwell time of 100us in both pulse count and analog modes) and seamless dual mode operation for 9 orders linear calibration response.

New application requirements now require faster sweep times for time resolved analysis (TRA) acquisitions, especially for emerging applications such as single nanoparticle analysis.

Samples containing mixtures of nanoparticles can be measured successfully using a separation technique such as Field Flow Fractionation (FFF) [1] or hydrodynamic chromatography (HDC) [2], coupled to ICP-MS.

When nanoparticles need to be measured in solutions, the number and size of the particles can also be determined directly (without a separation step), by measuring the frequency and peak height of the signals produced by the individual particles as they pass through the plasma. This requires a very fast TRA acquisition speed, as provided by the new revision of MassHunter.

The optimum integration time for 80nm Ag nanoparticle measurement has been shown to be in the region of 3 to 5ms [3].

- Dwell times longer than 5ms can lead to the inclusion of several particles in a single TRA time slice measurement (leading to over-estimation of the particle size and underestimation of the particle number).
- Dwell times shorter than 3ms can lead to incomplete measurement of single particle events, leading to underestimation of the size.
- Very short integration times also increase the RSD of the signal from the dissolved element, making it more difficult to differentiate the signal from the small particles and the signal from the dissolved component.

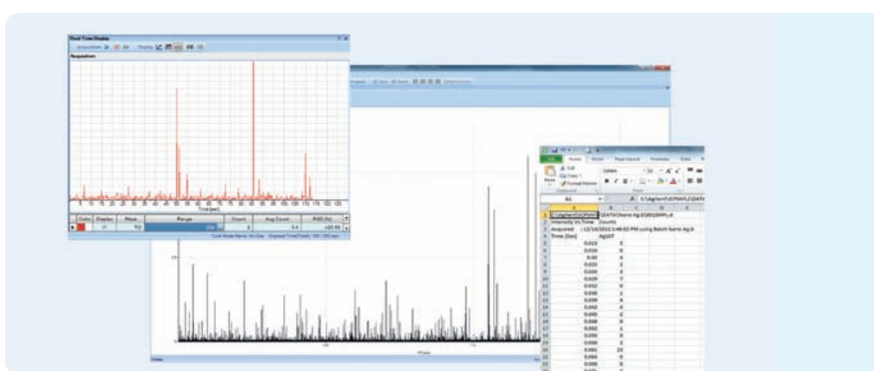


Figure 2. Acquisition and processing of fast (3ms) TRA signal for nanoparticles

Agilent 1200 Infinity LC support

The previous revisions of ICP-MS MassHunter provided direct control of most common Agilent 1200 Infinity LC modules, but G7201B adds support for several more LC modules especially related to Life Science applications, as shown below.

Additional Agilent 1200 Infinity Modules Supported	Part Number
Cap-LC pump	G1376A
Low-flow High Perf. ALS	G1377A
Low-flow Sampler	G1389A
TCC	G1316A

Furthermore, rev.B.01.02 can now directly control a 1200 Infinity LC system that also has a UV detector connected. This configuration was not previously possible, but can now be run successfully by using a branched APG remote cable and separate network cards in the LC and UV detector modules.

Contact your ICP-MS Product Specialist for more information on this exciting new possibility for direct, integrated setup and control of simultaneous UV and ICP-MS measurement for LC applications, using ICP-MS MassHunter.

Unsupported LC modules can still be controlled using co-resident LC/GC OpenLAB CDS or the Instant Pilot.

Chromatographic Data Analysis

Further improvements have been made in chromatography data analysis in rev.B.01.02, including:

- Global Compound Independent Calibration (CIC) for unknown peaks
- Calibration using Average Response Factor
- Improved Area Percent Report
- QDel (Quant Delete) for wrongly identified peaks in quant data

Flexible User Tune Modes

ICP-MS MassHunter introduced an innovative "Startup" concept for instrument optimization, with an automated process to monitor and update system settings based on a standard test procedure run each time the plasma is lit.

While immensely useful for routine laboratories, Startup offered limited flexibility for users of non-standard sample introduction systems or operating conditions (such as organic solvent analysis, laser ablation, cool plasma, and so on).

The new revision of MassHunter includes "User Tune" mode, which now enables the advanced functionality of Startup even when non-standard configurations and operating conditions are used.

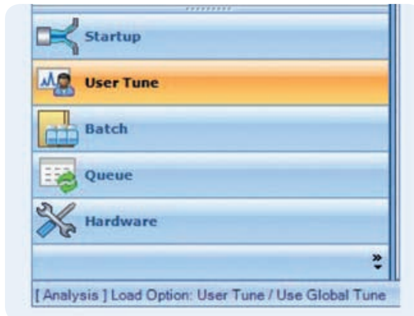


Figure 3. User Tune task

Global Tune

The B.01.02 revision also increases the flexibility of Batch tuning, with a Global Tune setting to allow the same tune conditions to be updated once, and then applied automatically across multiple batches.

This simplifies operation for many routine laboratories where different sample types may require different acquisition methods but all use the same values for parameters such as RF power, sampling depth and P/A Factors.

Compliance

As with previous versions of ICP-MS MassHunter, the new B.01.02 revision provides integration with Agilent's OpenLAB ECM to deliver a comprehensive, server-based regulatory compliance solution, to satisfy the requirements of the US FDA's 21CFR Part 11.

In addition, ICP-MS MassHunter G7201B rev.B.01.02 now integrates with Agilent's Spectroscopy Database Administrator (SDA).

ICP-MS with SDA now provides a cost-effective, single-PC based route to regulatory compliance for a single ICP-MS instrument. This option is ideal for laboratories that don't require the sever-based, "whole lab" solution provided by OpenLAB ECM.

SDA will be available from February 2013 and is backed by the same System Validation and IQ/OQ services that have been available for ICP-MS with OpenLAB ECM.

Availability

The new B.01.02 revision of ICP-MS MassHunter ships as standard with all new 7700 Series ICP-MS and 8800 ICP-QQQ instruments from December 2012.

The latest revision is also available for all existing 7700 Series and 8800 ICP-QQQ users. Current users of G7201B rev B.01.01 are entitled to a free update to rev B.01.02, which can be downloaded from the support website, or the media can be ordered through your support representative.

7700 Series users with earlier revisions of MassHunter (G7200B and G7201A) can purchase an upgrade to G7201B rev.B.01.02. This upgrade may require a new PC or on-site upgrade from 32bit to 64bit operating system.

References

1. Diaz, X., Johnson, W., Fernandez, D. and Naftz, D., Applied Geochem. (2009), 24, 1653-1665
2. Tiede, K., Boxall, A., Tiede, D., Tear, S., David, H. and Lewis, J., J. Anal. At. Spectrom., (2009), 24, 964-972
3. Tuoriniemi, J., Cornelis, G. and Hassellov, M., Anal. Chem. (2012), 84, 3965-3972

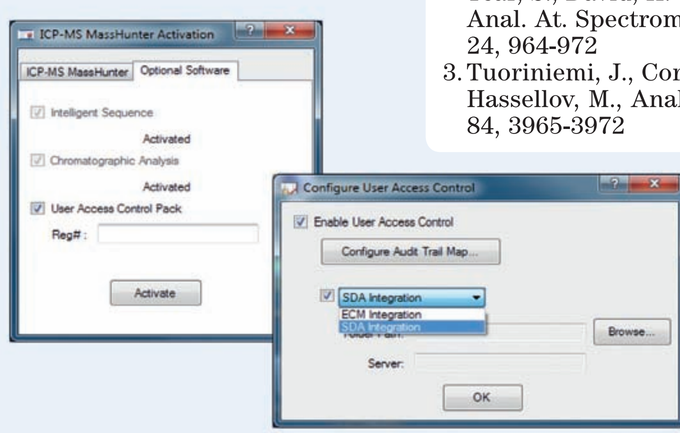


Figure 4.User Access Control activation and SDA configuration

User Profile: Funding Boost for LA-ICP-MS Research into Mineral Exploration

Prof. Leonid Danyushevsky
CODES CoE and School of Earth Sciences, University of Tasmania, Hobart, Australia

The Australian Research Council Centre of Excellence in Ore Deposits at the University of Tasmania (CODES) operates in close cooperation with the School of Earth Sciences (SES). The Centre was formed in 1989. It has grown substantially over the years and is now widely regarded as a global leader in ore deposit research. It is home to 40 highly qualified research staff and over 80 postgraduate students, making it one of the largest university-based teams of ore deposit researchers in the world.

CODES/SES established a laser-ablation ICP-MS facility in 1998. From the outset, the facility employed Agilent quadrupole ICP-MS instruments due to their exceptional reliability, high sensitivity and versatility, and the excellent technical and application development support that the company offers to its Australian customers. The original instrumentation consisted of an HP 4500 quadrupole ICP-MS and a NewWave Research LUV266 laser ablation microprobe. The facility has been steadily expanding in recent years, in terms of both the instrumentation base and the range of applications. Currently the laboratory houses a class 100 clean room for processing samples in an ultra-clean environment, and is equipped with 3 Agilent quadrupole ICP-MS instruments (7500a, 7500cx and 7700s) and 4 laser ablation microprobes (Resonetics RESOlution S-155; NewWave Research UP213 and UP193ss). All laser microprobes are equipped with specialized fast-response constant geometry ablation cells, which were designed in-house for the UP platform instruments. The wide range of instrumentation allows for development of specialized applications.

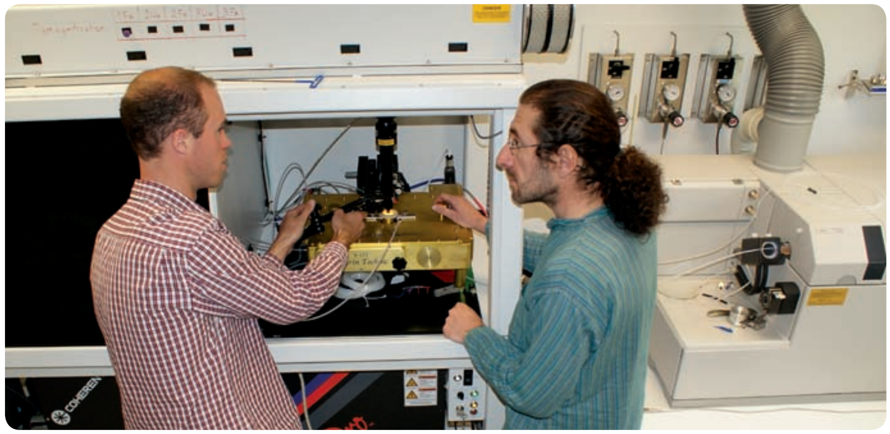


Photo of Leonid Danyushevsky, right, and Jay Thompson, working on the RESOlution S-155 laserprobe coupled to an Agilent 7500cx

Prof Leonid Danyushevsky has led the facility since 2002. Current staff members include CODES Senior Research Fellow Dr. S. Meffre, and four Laboratory Analysts S. Gilbert, J. Thompson, I. Little and E. Lounejeva.

The facility undertakes an active research program in the field of LA-ICP-MS. Current projects involve development of algorithms and data acquisition protocols for quantitative mapping of element distribution in minerals; development of LA-ICP-MS calibration standards; in-depth understanding of the laser ablation process and causes of elemental fractionation (laser wavelength and pulse width, laser energy, ablation cell design, configuration of the laserprobe-ICP-MS interface); and optimization of LA-ICP-MS instrumentation. Recent publications appeared in the Journal of Analytical Atomic Spectrometry; Geostandards and Geoanalytical Research and Geochemistry: Exploration, Environment, Analysis.

The current range of LA-ICP-MS applications is focused on geochemistry and includes analysis of trace and major elements in sulfide minerals with specially developed calibration standards; PGE analyses in sulfide minerals with specially developed calibration standards and metal-argide corrections; analysis of trace and major elements in silicate and oxide minerals and glasses; mapping of element distribution in minerals (Figure 1); analysis of Pb isotopic composition in sulfides and silicates; U-Pb dating in zircons, apatites & monazites; analysis of fluid and melt inclusions in minerals; and analysis of copper metal samples. Non-geological applications include analysis of biological samples such as otoliths and stylets.

In recognition of the importance of LA-ICP-MS technique for the needs of the Minerals industry, CODES has recently obtained funding from Newcrest Mining Ltd (A$ 2.5M over 5 years) to expand the capabilities of the LA-ICP-MS facility. A new specialized LA-ICP-MS R&D laboratory is currently being built. The new laboratory will initially house a new RESOlution S-155 laser probe and an Agilent 7700s ICP-MS

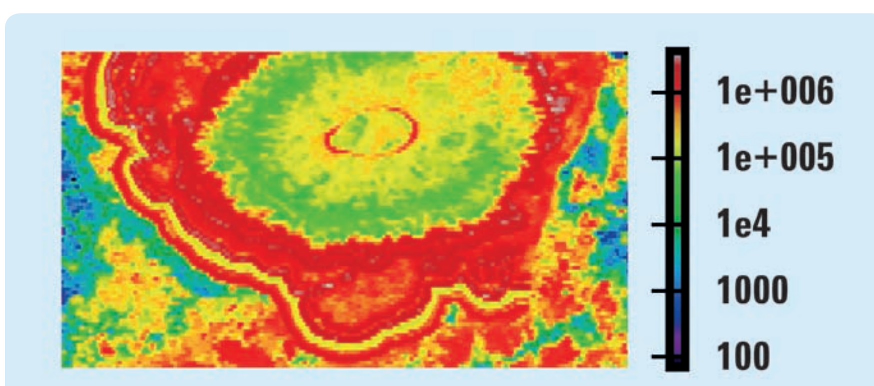


Figure 1. A LA-ICP-MS map of Sb distribution in a sulfide grain, in counts per second

and will become operational in April 2013. As a result of the Newcrest Mining funding, the scope of the research program within the LA-ICP-MS facility will be extended, with a particular focus on the development of calibration standards for analysis of sulfide minerals and development of user friendly software for fully quantitative mapping of element distribution in minerals.

Separately in 2012, the facility was awarded a US$ 40,000 research grant from Agilent for a project entitled "Laser-ablation ICP-MS analysis of spatial variations of sulfur isotopic composition: advancing applications in the field of ore deposit research". The project aims to accelerate uptake of LA-ICP-MS by commercial laboratories by optimizing three major aspects of the measurement of sulfur isotopes in sulfide minerals. These aspects are:

- Optimization of laser parameters
- Optimization of the laser ablation cell – ICP-MS interface, including configuration, design and construction, and minimization of memory effects
- Optimization of the ICP-MS collision cell operating parameters on Agilent 7700s to remove oxygen interferences from the ^{32}S and ^{34}S isotopes.

More Information

www.utas.edu.au/codes/

WPC 2013 Agilent Authored and Selected Co-authored Presentations

Oral Paper Title	Author(s)
Organic solvent analysis using an ICP-QQQ-MS (MS/MS capable) ICP-MS	Glenn Woods
Determination of challenging elements in the context of marine environmental analysis: exploring the potential of ICP-MS/MS	Daniel Proefrock, Andreas Prange (Agilent customer)
High-resolution elemental bio-imaging of Ca, Mn, Fe, Co, Cu and Zn employing LA-ICP-MS and H_2 reaction gas	David Bishop (Agilent customer)
Investigation of sulfur isotope fractionation and signal smoothing during the analysis of sulfides by LA-ICP-MS	Sarah Gilbert (Agilent customer)
Effects of small amount of N_2 on the drift in relative sensitivities in laser ablation ICP-MS for geological and biological applications	Leonid Danyushevsky (Agilent customer)
Determination of boron in high-temperature alloy steel using non-linear inter-element correction and MP-AES	Terrance D. Hettipathirana
Ultra-fast ICP-OES determinations of major, minor and trace elements in seawater using next generation sample introduction technology	John Cauduro

Poster Presentation Title	Author(s)
Application of MS/MS reaction cell in the Triple Quad ICP-MS for the determination of S, P, Si and Cl in organic solvents	Naoki Sugiyama
Lead isotope analysis: Removal of ^{204}Hg isobaric interference from ^{204}Pb using a quadrupole ICP-MS equipped with MS/MS technology	Glenn Woods
Ultra-trace analysis of gold and platinum group elements in geological samples using ICP-MS with mixed gases	Steve Wilbur, Craig Jones
Triple Quad ICP-MS: Illuminating the challenges in clinical analyses	Amir Liba, Pierre Dumas
Novel Approach to life science applications using Triple Quad ICP-MS/MS	Amir Liba
Determination of trace metallic impurities such as phosphorus and titanium in high purity silicon materials by ICP-MS/MS	Junichi Takahashi, Noriyuki Yamada
Uranium measurement in urine with the Agilent 7700x ICP-MS	Sébastien Sannac
Bioimaging of rice tissue with the use of a laser ablation system coupled to the Agilent 7700x ICP-MS	Sébastien Sannac
Effects of helium flow geometry on elemental fractionation in laser ablation ICP-MS	Jay Thompson, Leonid Danyushevsky
Effect of storage temperature and packing type on the trace metal analysis of wine	Jenny Nelson, L. Helene Hopfer, and Susan E. Ebeler
Trace level speciated analysis of Cr(III) and Cr(VI) using LC-ICP-MS	Jing Miao, Juane Song, Zhi-xu Zhang, Yan Dong
Determination of trace rare earth elements in high purity rare earth compounds by ICP-QQQ (ICP-MS/MS)	Kazumi Nakano, Yasuyuki Shikamori, Naoki Sugiyama
Simultaneous determination of trace elements in high purity steel by Triple Quadrupole ICP-MS/MS (ICP-QQQ)	Yasuyuki Shikamori, Kazumi Nakano, Tetsuo Nishiyama
Removal of titanium based interferences on nickel, copper and zinc on ICP-QQQ with MS/MS based reaction technology	Peter Planitz, Jörg Hansmann
Determination of palladium content in valacyclovir hydrochloride using ICP-OES with Auxiliary Gas Module	Dharmendra Vummitti
Cognac analysis using the Agilent 4100 MP-AES	Maud Costedoat
Vegetable oil analysis using the Agilent 4100 MP-AES	Maud Costedoat

Ultratrace Measurement of Calcium in UPW using ICP-QQQ

Albert Lee, Vincent Yang, Jones Hsu, Eva Wu and Ronan Shih
BASF Taiwan Ltd., Taipei, Taiwan
Katsuo Mizobuchi
Agilent Technologies, Tokyo, Japan

Introduction

In the semiconductor industry, the control of metal impurities in the process chemicals used in the manufacture of semiconductor devices is critical to achieve the required product performance and yield. As device performance is continually increasing, the required impurity control becomes ever more stringent. For example, metal content of the ultra pure water (UPW) used in the manufacturing process must be at the sub-ppt level. ICP-MS is the standard technique used for the trace metals analysis of semiconductor chemicals and devices. The most common instrument and measurement technique used in the semiconductor industry is single quadrupole ICP-MS (ICP-QMS) with cool plasma. The cool plasma technique [1], developed in the mid 1990's, enables the quantification of key contaminant elements at the single ppt level. Collision and reaction cell ICP-QMS, developed from 2000 onwards, enabled the direct analysis of more complex semiconductor matrices, but did not improve on the detection limits or background equivalent concentration (BEC) of cool plasma. To achieve measurement at the sub-ppt level, reduction of the BEC is required. The Agilent 8800 Triple Quadrupole ICP-MS (ICP-QQQ) uniquely operates in MS/MS mode, providing new reaction cell capability that enables a BEC of <50 ppq for Ca.

Experimental

Instrumentation

A standard Agilent 8800 Triple Quadrupole ICP-MS mainframe (option #200 semiconductor version) was used. The sample introduction system features a quartz torch and spray chamber, and a PFA concentric nebulizer (which was operated in self-aspiration mode). Platinum interface cones were also used. Cool plasma conditions were used throughout and plasma parameters are shown in Table 1.

RF (W)	600
Carrier gas (L/min)	0.7
Make up gas (L/min)	1
Sampling depth (mm)	18

Table 1. 8800 ICP-QQQ operating conditions

Compared to conventional ICP-QMS, the 8800 features an additional quadrupole mass filter (Q1), situated in front of the Octopole Reaction System (ORS^3) cell and quadrupole mass filter (now called Q2). The Agilent 8800 can be operated in two scan modes: single quad mode and MS/MS mode. Single quad mode emulates ICP-QMS, with Q1 operating either as a simple ion guide or as a bandpass filter. MS/MS mode is unique to ICP-QQQ: Q1 operates as a 1 amu window mass filter, selecting the m/z of ions that are allowed to enter the cell, and rejecting all other masses. Because plasma ions (Ar^+, O^+, N^+, etc.) are eliminated from the cell by Q1, analyte ion transmission through the cell is greatly increased. When a reaction gas is added, reaction efficiency is also greatly enhanced, enabling the use of lower reaction gas flow rates which also increases ion transmission and therefore sensitivity.

Calibration standards

A Ca standard was prepared in UPW acidified with 0.1% high purity HNO_3. This was used to make 50 ppt and 100 ppt additions to a UPW blank acidified with 0.1% high purity HNO_3.

Results

The sample was acidified to 0.1% HNO_3. Figure 1 shows the BECs obtained for Ca using the method of standard additions (MSA), under three different operating conditions: single quad mode with no cell gas, MS/MS mode with no cell gas, and finally MS/MS mode with an H_2 cell gas flow of 1 mL/min. The first operating condition emulates the Agilent 7700 ICP-QMS operated in cool plasma mode. The obtained BEC of 6.8 ppt is similar to that routinely achieved with the Agilent 7700.

Using MS/MS mode (without cell gas) improved the BEC to 1.4 ppt. MS/MS mode with H_2 at 1 mL/min in the cell further improved the BEC down to 0.041 ppt (41 ppq). The obtained MSA plot is shown in Figure 2. The Agilent 8800 achieved a BEC for Ca in UPW two orders of magnitude lower than the BEC obtained using conventional ICP-QMS.

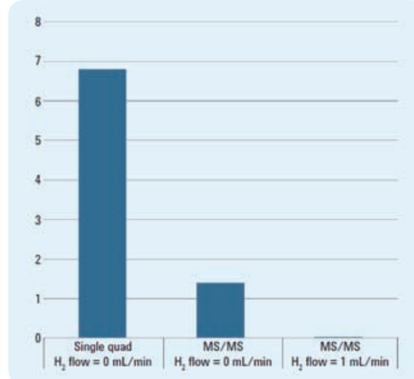


Figure 1. BECs for Ca obtained using single quad mode with no cell gas [6.8 ppt], MS/MS mode with no cell gas [1.4 ppt], and MS/MS mode with an H_2 cell gas flow of 1 mL/min [0.041 ppt].

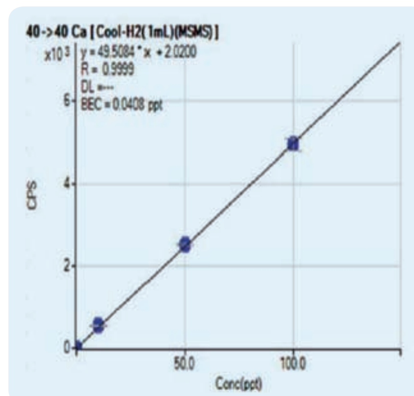


Figure 2. MSA calibration plot for Ca using MS/MS mode with H_2 cell gas at 1 mL/min.

Conclusions

The plasma derived polyatomic ion NO^+, which is formed in cool plasma mode, can generate small amounts of Ar^+ in the cell by charge transfer reaction, which interferes with Ca at *m/z*=40. The Agilent 8800 ICP-QQQ operating in MS/MS mode, which is unique to ICP-QQQ, stops plasma derived ions from entering the cell. This prevents unwanted reactions from occurring, and so eliminates the reaction product ion overlaps that are characteristic of reaction mode on a conventional ICP-QMS. This enables the Agilent 8800 Triple Quadrupole ICP-MS to achieve a BEC of 41 ppq for Ca in UPW.

References

1. K. Sakata and K. Kawabata, Spectrochim.Acta, Part B, 1994,49,1027

More Information

Agilent publication 5991-1693EN.

Customers Enjoy a Live Demo of the 8800 ICP-QQQ at Well-attended Workshop

Jérôme Darrouzes
European Spectroscopy Marketing Manager, Agilent Technologies

Agilent's Tobias Gysin welcomes the delegates to the ICP-QQQ Workshop held in Waldbronn in December 2012.

Since its introduction at the ASMS conference in March 2012 where it was voted 'Instrument of the Show', the Agilent 8800 Triple Quadrupole ICP-MS has enjoyed sales success beyond all expectations. Many of the early adopters of the new technology are based in Europe and representatives from many of these companies and institutions joined non-users and Agilent experts at a 8800 Workshop held at Agilent's sales and demo facility in Waldbronn, Germany. In total, there were more than 50 attendees from 10 different countries.

Delegates were given an opportunity to question Agilent's R&D engineer and inventor of the ICP-QQQ technology, Noriyuki Yamada, on the fundamentals of the technique including MS/MS mode, which has redefined application and measurement possibilities beyond the capabilities of conventional ICP-MS. There was then a series of oral presentations where users shared their early experiences and impressions of using the 8800 and predicted how it might be used in the future. These included:

- ICP-QQQ - an elegant solution for difficult samples by Prof. Walter Gößler, Karl-Franzens-Universität Graz, Austria
- Accurate determination of S in organic matrices using isotope dilution ICP-QQQ by Dr. Lieve Balcaen, Universität Ghent, Belgium
- Application of ICP-QQQ for environmental analysis and its perspectives for life sciences – first results by Dr. Daniel Proefrock, Helmholtz Zentrum Geesthacht, Germany
- Save perfect pixels - application of the ICP-QQQ-MS for elemental impurity profiling in display industry by Katharina Böting, Merck Darmstadt, Germany
- Removal of difficult interferences in digested geological and soil samples by Karl Andreas Jensen, Norwegian University of Life Sciences, Aas, Norway

In the afternoon, the attendees were divided into two groups and one group joined Agilent's applications engineers Peter Planitz and Séb Sannac, in a practical ICP-QQQ hands-on workshop while the second group were given the opportunity to discuss ICP-QQQ applications, further developments and analytical needs with Agilent's Uwe Noetzel, Jörg Hansmann, Yolande Abdelnour, and Noriyuki Yamada.

Agilent's Séb Sannac pictured with a group of delegates during one of the hands-on demonstration sessions of the 8800.

Feedback from the day's events was overwhelmingly positive with participants particularly impressed with seeing the 8800 in action.

For more information on the Agilent 8800 Triple Quadrupole ICP-MS and to see a video animation of the instrument, go to **www.agilent.com/chem/icpqqq**

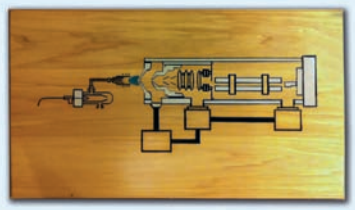
The 6th Agilent-donated Plasma Prize Goes to Professor Jakubowski

The 6th Biennial European Award for Plasma Spectrochemistry 2013 has been awarded to Norbert Jakubowski from the Federal Institute for Materials Research and Testing (BAM, Berlin, Germany) for his research into inorganic trace and ultra trace analysis of liquids and solids by ICP-MS and GD-MS, elemental speciation analysis and development of elemental tags for quantitative detection of biomolecules.

Agilent Technologies Europe has donated the "Plasma Prize" since its inception in 2003. The prize is designed to promote analytical plasma spectrochemical developments and applications in Europe. The winner receives a EUR5000 cash prize and enjoys a trip to Japan to present a symposium or Agilent event. Previous winners of the Plasma Prize include:

2003: Prof. Dr. Detlef Guenther of ETH Zurich, Switzerland.
2005: Prof. Jean-Michel Mermet of University of Lyon, France.
2007: Klaus G. Heumann of Johannes-Gutenberg-University of Mainz, Germany.
2009: Prof. Annemie Bogaerts of Univeristy of Antwerp, Belgium.
2011: joint winners Prof. Vanhaecke of University of Ghent, Belgium and Prof. Sanz-Medel of University of Oviedo, Spain.

A Wooden Inlay of a 4500: The Ultimate Wedding Present?



Wooden inlay of an Agilent 4500 by chemist and artist, Michael Fricke

What do you give a pair of chemists and ICP-MS operators as a wedding present? If you're a talented artist and know the layout of an ICP-MS, the answer is an inlay of an Agilent 4500!

The artwork pictured above was crafted by Dr Michael Fricke, a chemist at the pharmaceutical company Boehringer Ingelheim's Ben Venue Laboratories, in Ohio. This personalized piece was created as a wedding gift for Doug and Daisy Richardson. All three chemists received doctorates from the University of Cincinnati and were former 4500 users.

The wooden inlay was made on a board of three joined pieces of maple with a routered edge. The individual shapes are cut from grey and black plastic sample sheets and were inlaid with a black epoxy and sanded to a 600 grit. The piece was finished with three layers of lacquer.

The inductively coupled plasma was cut from a piece of dichroic glass. Dichroic glass was originally developed by NASA and contains multiple micro-layers of metal oxides which give the glass optical properties. Dichroic glass will transmit one particular color and reflect a completely different color.

The plasma shape was scored into the glass and snapped out into a rough piece. After grounding the edges, the plasma was added as the final step. The plasma is either grey or blue depending on the angle of view. The entire project took three months to complete.

Your Invite to an Agilent Event at the Winter Plasma Conference 2013

Meet our team of atomic spectroscopy experts at the Agilent booth #8.9 and at the following informative events:

- **Agilent Lunch & Learn Symposium** – join our interactive symposium and learn about the benefits and application capabilities of the 8800 ICP-QQQ and 4100 MP-AES. Tues, February, 12 at 1pm, with refreshments.
- **Agilent Technologies Evening Event** – join our atomic spectroscopy team for a friendly evening event, Wed, February, 13 at 6.30pm, with dinner and music!

Attendance at the Agilent events is free, but space is limited, **so reserve your place online** at: **www.agilent.com/chem/wpc**

Conferences. Meetings. Seminars.

- **Inaugural Agilent ICP-MS Users' Meetings in Vietnam**
  Tues, January 29 at the Sofitel Plaza, Hanoi.
  Wed, January 30 at the New World Hotel, Ho Chi Minh City.
  Speakers: Katsuo Mizobuchi, ICP-MS Senior Application Chemist, Agilent Technologies, Japan, and Steven Pang, Spectroscopy Business Manager, Agilent Technologies, Singapore
  Registration Contact: Kim Trang and Hoang Khuong, representing office of Agilent Technologies Singapore (Sales) Pte Ltd.
  Email: **kim.trang@non.agilent.com; khuong_hoang@non.agilent.com**
- **European Winter Conference on Plasma Spectrochemistry**
  February 10-15, Krakow, Poland, **www.chemia.uj.edu.pl/ewcps**
- **MSACL Conference and Tradeshow**, February 9–12, San Diego, CA, **www.msacl.org**
- **PDAC Conference and Tradeshow**, March 3–6, Toronto, Canada, **www.pdac.ca**
- **Agilent Science and Technology Symposium (ASTS) Virtual Seminar and Workshop**, March 5-6
- **ACS Spring Meeting**, April 7–11, New Orleans, LA, **www.acs.org**

Agilent ICP-MS Publications

To view and download the latest ICP-MS literature, please follow the links from **www.agilent.com/chem/atomicspec**

- **Technical Overview:** Agilent 8800 Triple Quadrupole ICP-MS: Understanding oxygen reaction mode in ICP-MS/MS, 5991-1708EN
- **Application note:** Ultra trace measurement of calcium in Ultra Pure Water (UPW) using Agilent 8800 Triple Quadrupole ICP-MS, 5991-1693EN
- **Application note:** Determination of Chromium in Gelatin Capsules using an Agilent 7700x ICP-MS, 5991-1531EN
- **Application note:** Removal of hydride ion interference (MH^+) on Rare Earth Elements (REEs) using the 8800 Triple Quadrupole ICP-MS with oxygen reaction mode, 5991-1481EN
- **Application note:** Ultratrace measurement of sulfur and phosphorus in peptides by capillary LC-ICP-MS using the 8800 Triple Quadrupole ICP-MS, 5991-1461EN

Agilent ICP-MS Journal Editor

Karen Morton for Agilent Technologies
e-mail: icpms@agilent.com

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