The **Mass Spec Source**™

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For Mass Spectrometry and Chromatography

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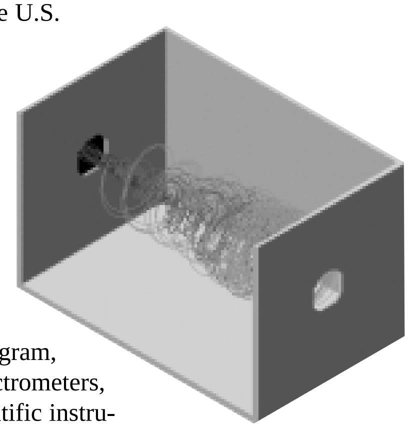
NEWS *from S.I.S.*

SIS Acquires License to Continue SIMION Development.

SIS obtained an exclusive license agreement from the U.S. Department of Energy's Idaho National Laboratory (INL) for the rights to develop and maintain the software code for the SIMION suite of ion optics modeling software. The agreement will allow SIS to enhance, update and maintain the software, to satisfy the needs of the user community, and benefit the industrial partner and the government. Additional details are available on the web at: **www.simion.com**.



SIMION 3D, originally developed by INL employee David Dahl, is an award-winning Windows PC based program, widely used by manufacturers and designers of mass spectrometers, electron microscopes, electron multipliers and other scientific instruments to study the optics of charged particles through electric and magnetic fields in two and three dimensions. SIMION is designed to provide direct and highly interactive methods, balancing ease-of-use, speed, accuracy, and affordability in order to simulate a variety of real-world ion optics problems. SIMION can model complex problems using a workbench strategy that can hold up to 200 2-D and/or 3-D electrostatic or magnetic field arrays, each of up to 50,000,000 points, which the user can visualize in 3D and cut away to inspect ion trajectories and potential energy surfaces to gain intuition and collect quantitative data.

SIS has distributed SIMION since 1996 and has more recently developed accessory tools (SIMION SL) to expand the capabilities of SIMION to include the importation of CAD files directly into SIMION, a new compiler and other tools requested by customers. Similar features along with an updated user interface are planned for inclusion in the next major release of SIMION scheduled for sometime in 2006. SIS has also established a SIMION web site (www.simion.com) to provide customers with information and support on SIMION.

NEW Product - CPO Ion Optics Modeling Software

If SIMION is not powerful enough for your ion optics modeling applications, SIS now sells and supports CPO - Charged Particle Optics Software. CPO is a software application that calculates electrostatic/magnetic fields and the trajectories of charged particles through those fields, a bit like SIMION. However, CPO differs fundamentally in its more powerful and accurate methods of calculation (Boundary Element Method--BEM), and it offers well-tested space-charge, cathode emission, and other advanced features. Details are available on our web site at: **http://simion.com/cpo/**

SIS MS SOURCE CLEANING KITS

MASS SPEC SOURCE CLEANING KITS FROM SIS

Based on more than 25 years of experience in cleaning mass spec sources, SIS has put together two convenient kits to help you in the service and maintenance of your mass spectrometer. In these kits we combined the various tools, polishing and cleaning materials that can be used to clean your source. We have also included instructions on source cleaning from SIS based on our experiences of cleaning hundreds of sources over the years. All of the products listed are available individually in our catalog, if you just need a few items or need to replenish your supply.

THE MAJOR KIT

The Major kit includes most everything that is needed to clean a mass spectrometer source. The selection of felt polishing tips and fine abrasive polishing compound makes it fast and easy to clean contamination in the metal source parts. We have found the Micro Mesh abrasives included in the kit to be an excellent product for cleaning and polishing the metal parts and we use it extensively in our laboratory. The selection of other products listed below aid in cleaning and handling the small instrument parts.

Part No.	Description	Price
SK1	**Major MS Source Cleaning Kit**	$428.40

Kit includes:

1	Dremel Moto-tool kit	**2**	Micro Mesh Board
1	Polishing compound	**500**	Cotton Tipped Applicators
5	Felt Polishing Tips	**1**	600 Grit Aluminum Oxide
12	Felt Polishing Wheel, 1/2" dia.	**1**	Disposable Dust-Off XL
5	Felt Polishing Wheel, 1" dia.	**1**	Tweezer Set
2	Mandrels for Polishing Wheels	**1**	Six Piece Screwdriver Set
1	Mandrels for Polishing Tip	**1**	Needle Nose Pliers
24	Pair of Nylon Gloves	**1**	Binocular Magnifier
300	Clean Tex Cloths, 9" x 9" wipes	**1**	SIS Source Cleaning Instructions
2	Micro Mesh Abrasive Sheet Kit		

THE MINOR KIT

The kit includes Micro Mesh polishing cloths and boards for cleaning and polishing the metal parts. The kit also includes a selection of other products listed below to aid in cleaning and handling the small instrument parts.

Part No.	Description	Price
SK2	**Minor MS Source Cleaning Kit**	$191.76

Kit includes:

24	Nylon Gloves, Large, Case of 24 pair
300	Clean Tex Cloths, 9" x 9" wipes
2	Micro Mesh Abrasive Sheet Kit
2	Micro Mesh Polishing File Board
500	Cotton Tipped Applicators, pkg. of 100,
1	4 oz. of 600 Grit Aluminum Oxide
1	Disposable Dust-Off XL,
1	Tweezer Set,
1	Six Piece Jewelers Screwdriver Set,
1	Binocular Magnifier,
1	SIS Source Cleaning Instructions

OTHER CLEANING EQUIPMENT

If you do not have an Ultrasonic cleaner in the lab, one is available from SIS. This is normally recommended to clean and wash the cleaned source parts after they have been polished or abrasively cleaned.

Part No.	Description	Price
ME 2.1	Mettler 2.1 Ultrasonic Cleaner	$425.00

FEATURE

Yttria Coated Mass Spectrometer Filaments

by John J. Manura, Scientific Instrument Services, 1027 Old York Road, Ringoes,NJ 08551

Historically most mass spectrometers have used plain uncoated filaments usually constructed of rhenium, tungsten or an alloy of rhenium and tungsten. In the past twenty or so years, several manufactures have tried using thoria (thorium oxide) coated iridium filaments in their mass spectrometers or leak detectors. This thoria and yttria coating technology came out of the vacuum tube industry in the 1940's and early 1950's. The thoria coated iridium filament provides longer filament life because the thoria work function was lower than tungsten, the filament required less power and it operated at lower temperatures. The major disadvantage of thoria is the environmental issues due to the exposure to the alpha particles emitted by thorium. Yttria (Yttrium Oxide) has been used as a replacement by several manufacturers of leak detectors and ion gauge tubes. SIS has been investigating Yttria (Yttrium Oxide) as a replacement for use in mass spectrometer filaments. The work function of Yttrium and Thorium are very similar (3.1 eV versus 3.41 eV respectively) and Yttria does not present the environmental issues associated with Thoria.

MECHANISM OF EMISSION

It has been reported by several authors in the early literature that free Yttrium (Y) is released within the Yttrium Oxide coating during the heating of the filament during the activation phase and this free Yttrium (Y) migrates to the surface of the oxide coating. It is this free metal film of Yttrium (Y) on the surface of the oxide coating that results in the emission characteristics of the Yttria coated filaments.

PREPARATION OF FILAMENTS

The filament wires were spot welded to metal body filament presses.**(Fig. 1)** The filaments were thoroughly cleaned and Yttria (Yttrium Oxide) was coated onto the filaments using an electrophoretic process. After coating the Yttria onto the filaments, they were inspected for integrity of coating and the film thickness was measured.

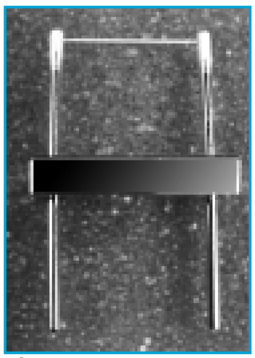


Figure 1 - Yttria Coated Filament

Yttria was coated onto various filaments wires and the emission characteristics were studied. Filaments were tested on the SIS filament testing station shown in **Figure 2**. This station has been used in filament studies we have published previously and is routinely used to study filament behavior. This filament testing station permits the simultaneous study of up to 12 filaments. The DC voltage and current through each filament can be varied and the emission current between the filament and a collector is measured. The emission voltage between the filament and the collector was set to 70 volts DC, which is the standard emission voltage used in most EI mass spectrometers. For each of the studies as the filament current was increased in 0.1 amp increments, the filament current, the filament voltage and the emission current were measured using 3 digit digital voltage and current meters. Filament temperatures were calculated using the Stefan Boltzman equation using the measured filament current and voltage as well as the physical dimensions of the filament wire.

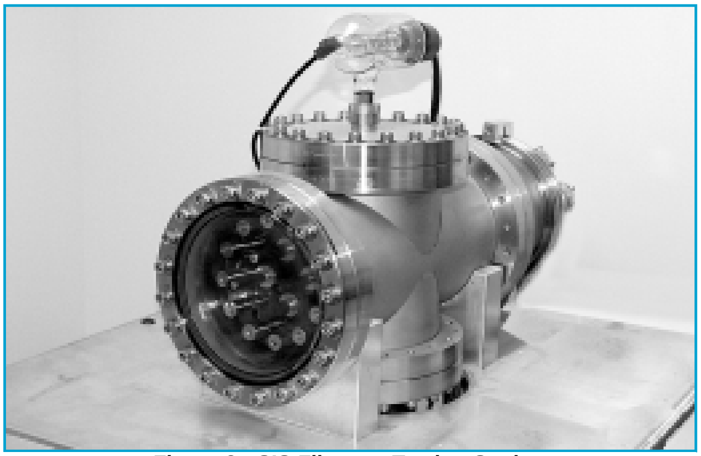


Figure 2 - SIS Filament Testing Station

COMPARISON OF THORIA AND YTTRIA COATINGS

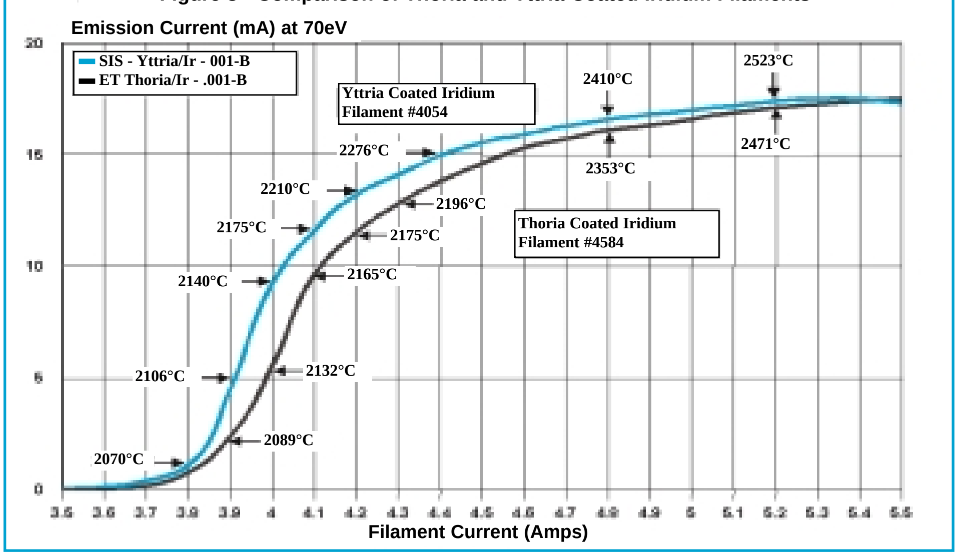
The chart **(Fig.3)** compares two Iridium filaments, one coated with Thoria (Thorium Oxide) and the other with Yttria (Yttrium Oxide). The filaments consisted of a filament press with a 10.0 mm length of 0.007" diameter Iridium wire. Yttria and Thoria were electrophoretically deposited on the filament wires to a thickness of 0.0005".

As can be seen from the chart **(Fig.3)** the emission currents of the Yttria and Thoria filaments are very similar. For both the thoria and yttria coated filaments, the filament operates at about 2200°C to achieve 10 mA of emission current. This study and the following studies confirm the feasibility of using Yttria as a replacement for Thoria on filaments for mass spectrometers.

STUDY OF YTTRIA COATED RHENIUM FILAMENTS

Rhenium filaments were coated with Yttria to determine its application for mass spectrometer filament manufacture. Emission plots of both Rhenium and Yttria coated Rhenium are shown

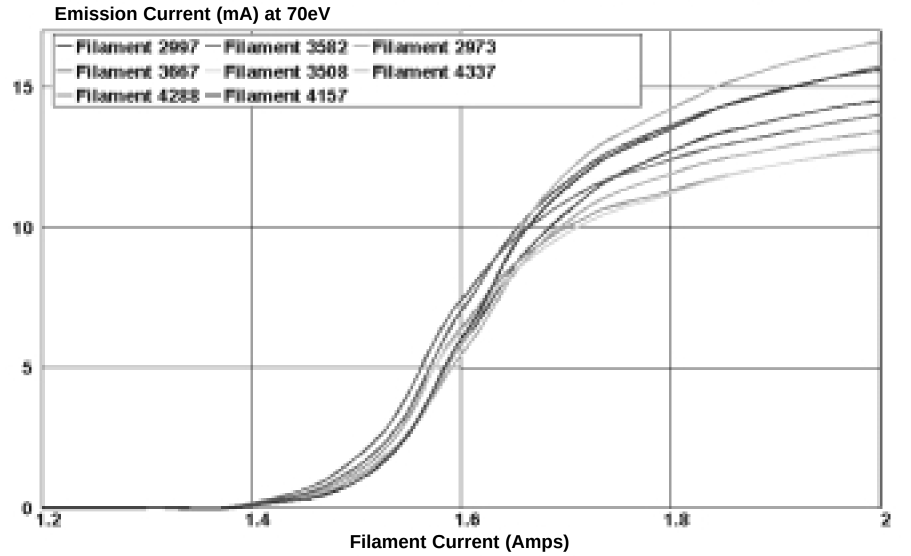
Figure 3 - Comparison of Thoria and Yttria Coated Iridium Filaments



below. Rhenium by itself has often been used as a mass spectrometer filament and therefore emits over a broad current range as shown in **Figure 4**.

As shown in the chart **(Fig. 4)**, when the Rhenium filament is coated with Yttria it emits at a significantly lower filament current than the plain uncoated rhenium filament. The Yttria coated filament required about 70% of the current and power to obtain the same emission as the uncoated filament wire. Emission occurred at temperatures between 1850°C and 1950°C for the Yttria coated rhenium filament. The Yttria coated filament provides emission at about 500° lower in temperature than the uncoated filament to achieve the same emission current. This will result in good filament emission at a lower filament temperature and would be expected to produce longer filament life with the Yttria coated filaments.

Figure 5 - Yttria Coated Re Filament (0.0009"Y Coating) - Reproducibility



REPRODUCABILITY OF YTTRIA COATED RHENIUM FILAMENTS

A set of 9 rhenium (.0055" diameter) filaments were coated with Yttria to a thickness of 0.0007" to 0.0010" to determine the reproducibility of manufacturing these filaments. The results are shown in **Figure 5**. The filaments were very reproducible in the emission range of 0 to 10 milliamps of emission, but this variation was probably due to the variation in thickness of the Yttria coatings or variation in the distance between the filament and the collector since different mounting positions were used for each of the filaments in the testing station.

In general we have demonstrated that we can reproducibly produce filaments with our processes and that film thicknesses between 0.0005" and 0.0010" thick provide for optimum performance and uniform coatings of the filament surface.

FILAMENT TESTING ON AN AGILENT™ MSD

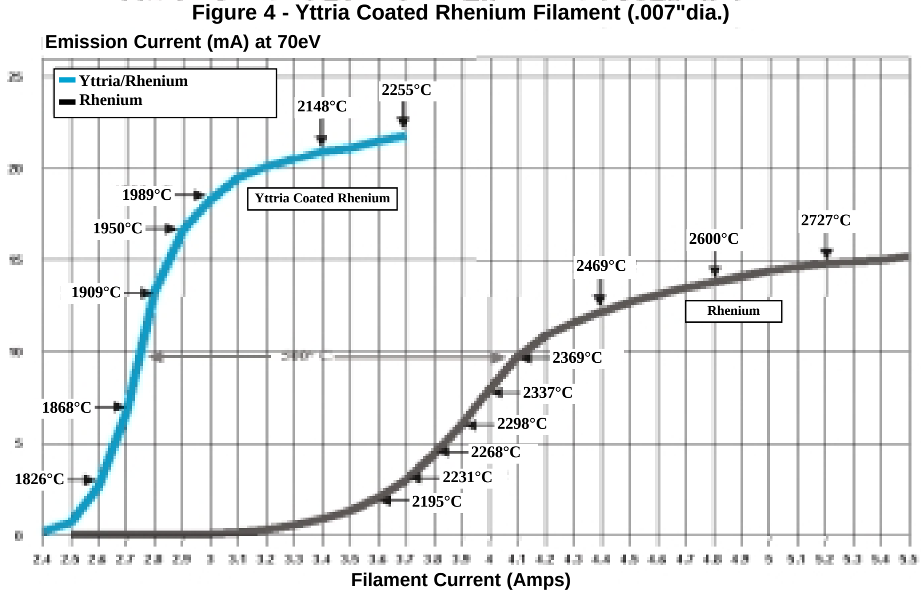
The next study was done to compare the actual operation of the Yttria coated filaments in a mass spectrometer. Two filaments were installed in an Agilent 6890 MSD. The first filament **(Filament #1)** was a plain 0.0055" rhenium filament which is the standard filament normally used in the MSD. The second filament was the same style filament, 0.0055" rhenium, coated with Yttria to a thickness of 0.0005". The mass spectrometer was operated in the normal EI mode and was tuned with each filament using the standard Agilent ChemStation Autotune. In both cases the filament emission current was set to 34.96 in the ChemStation tune setup.

The standard uncoated rhenium filament **(Filament #1)** operated at a measured filament voltage of 2.059 Volts AC. The Yttria coated filament **(Filament #2)** operated at measured filament voltage of 1.455 volts, which is about 70% of the voltage requirements for the non Yttria coated filament. This data agrees with the previous study above in which filament current and power for the Yttria coated rhenium filament were reduced to 70% of that required for an uncoated filament. This reduction in filament voltage and conversely filament current results in lower filament temperature and it is expected that the filament life will be increased. However, actual lifetimes of Yttria coated filaments in a real world mass spectrometer requires additional testing. It has been reported that these filaments are subject to poisoning by inorganics such as Chlorine and Flourine. The Yttria coated filament has been used in our MSD for about 3 months now and is still working fine.

CONCLUSION

The above studies demonstrate the feasibility of using Yttria coated iridium and rhenium filaments in a mass spectrometer. Yttria is a good replacement for Thoria and eliminates the environmental problems associated with Thoria. Yttria coated filaments require less power than uncoated filaments and the filament operates at lower temperature to achieve the same emission as the uncoated filaments. Historically iridium has been used as a base metal for Thoria and Yttria coated filaments, however we have demonstrated that Rhenium is also a viable alternative to Iridium and may be superior. We have demonstated the SIS can reproducibly manufacture Yttria coated filaments to meet the end users requirements.

Figure 4 - Yttria Coated Rhenium Filament (.007"dia.)



SIS Manufacture of Yttria Coated Filaments

SIS can now manufacture Yttria coated filaments. This can be done in a prototype and production environment. We can coat Iridium, Rhenium or Tungsten filaments with Yttria coating from 0.0025" to 0.0010" thickness. We can manufacture straight filament wires and ribbons as well as coil or pin shaped filaments. We also manufacture filament presses and custom design filament assemblies for our customers. We can work with you to develop and test filaments for your application and consult with you in your filament design. We have capabilities for small to large volume production quantities.

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541010HPUG	NIST 05 Upgrade for Agilent ChemStation	$1,195.00

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Phone: 908-788-5550 FAX: 908-806-6631 Web: http://www.sisweb.com

The New Scientific Instrument Services 2006 - 2007 Catalog is now in production and will be distributed January 2006. Due to the high cost of printing and mailing we are updating our customer list. Please fill out the form below and fax it back to us at:

(908) 806-6631

or if you prefer go to our web site and update your name and address online at:

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- ❒ S.I.S. GC/MS Supplies Catalog**(C)**
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- ❒ Mass Spec Source Newsletter**(MSS)**
- ❒ Cryo-Trap**(CRY)**
- ❒ SIMION

2. What additional services or product lines would you like SIS to provide?

____

____

3. What Mass Spectrometer(s) do you have in your lab?

Agilent Technologies

- ❒ 5890/5988/5989**(A1)**
- ❒ 5970**(A2)**
- ❒ 5971**(A3)**
- ❒ 5972**(A4)**
- ❒ 5973**(A5)**
- ❒ GC 5890, 6890**(A6)**
- ❒ 1100 LC/MS**(A7)**
- ❒ Other____________**(A8)**
- ❒ 5975**(A9)**

Finnigan

- ❒ 3000/3200/OWA/1020/5100**(F1)**
- ❒ 4000/4500**(F2)**
- ❒ Quantum**(F3)**
- ❒ Incos 50/500/XL**(F4)**
- ❒ GCQ**(F5)**
- ❒ Trace/AQA**(F6)**
- ❒ LCQ/Duo/Deca**(F7)**
- ❒ LC/MS**(F8)**
- ❒ Polaris/ITD**(F9)**
- ❒ ICP**(F10)**
- ❒ TSQ/SSQ**(F11)**
- ❒ MAT90/8200/HiRes**(F12)**
- ❒ Other___________**(F13)**

VG/Fisons/MicroMass

- ❒ Platform**(VG1)**
- ❒ LC/MS**(VG2)**
- ❒ Autospec**(VG3)**
- ❒ TRIO 1000/2000**(VG4)**
- ❒ Quattro**(VG5)**
- ❒ Micromass**(VG6)**
- ❒ 70/70, ZAB**(VG7)**
- ❒ Other __________**(VG8)**
- ❒ MD800**(VG9)**

Varian

- ❒ Saturn I, II, III**(V1)**
- ❒ Saturn 2000**(V2)**
- ❒ 1200**(V3)**

Other Manufacturers

- ❒ JEOL**(JE1)**
- ❒ Sciex**(SC1)**
- ❒ Nermag**(NR1)**
- ❒ Perkin-Elmer QMass**(PE1)**
- ❒ Perkin-Elmer MS**(PE2)**
- ❒ Waters Integrity**(WA1)**
- ❒ LECO**(LE1)**
- ❒ Extrel**(EX1)**
- ❒ Shimadzu**(SH1)**
- ❒ Vestec**(VE)**
- ❒ Balzers**(BZ1)**
- ❒ Nicolet**(NC1)**
- ❒ Bruker**(BR1)**
- ❒ Leybold Inficon**(LB1)**
- ❒ Ion Spec**(INS)**
- ❒ Other __________**(MS)**

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