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Technical Information

The Problem of Measuring Low Level Tantalum

Ever since the introduction of the VG9000, the slits, cells and sample holders have been made from Tantalum. There are good reasons for this: it is resistant to aggressive acid cleaning; it is machinable (albeit with difficulty); and it is effectively mono-isotopic.

However, there has always been a significant contribution to the spectrum from the Tantalum, effectively giving a detection limit of a few parts per million. In addition TaO interferes with the only isotope of Gold.

There are several possible sources of this tantalum signal;

- The sample chuck, made from tantalum and at cathode potential. However, experience shows that this tends to be covered by matrix redeposition after analysis;
- The cell walls. These are at anode potential and are therefore should not be sputtered. In addition they are again covered by matrix redeposition;
- The Ion Exit Slit at the rear of the cell. Ions and neutrals pass through here at low energy and are unlikely to remove tantalum from the slit edges.
- The focus plates are too far from the beam to be a likely source;
- The source defining slit. This is clearly damaged by the beam passing through, the resulting wear can be clearly seen. It is possible that the tantalum is removed during elastic collisions with the matrix or argon ions, producing a source of tantalum ions that have the correct energy to pass through the mass spectrometer.

Until recently, as far as I am aware, no experiments were carried out to investigate this. Recently, however, MassCare has produced two dimensionally identical slits, one made from Tantalum, the other from Stainless Steel. These have been compared using a sample of pure Gallium, and the results are shown in the table overleaf.

Steel Slit	
Element	mg/kg
Cr	0.35
Fe	1.2
Ni	0.10
Ta	0.17

Tantalum Slit	
Element	mg/kg
Cr	0.0002
Fe	0.009
Ni	0.006
Ta	3.1

Matrix Material: High Purity Gallium (7N)

It is clear that the main components of the slit material are present in the spectrum. The slits were changed over several times to eliminate any possibility of the effect being due to memory.

As a result, MassCare has started to introduce slit plates made from different materials. The first alternative to be introduced is Niobium, thus allowing the analysis of lower levels of Tantalum in a Niobium matrix.

The slit plates can be made with the usual 12.5, 25, 40 or 50 micron slits, and either 3 or 4 slits per plate.

Obviously there will be other materials that may suit your requirements. And it is also possible to manufacture sample chucks and even cells from alternative materials.

If this is of any interest to you, then please do not hesitate to contact us at MassCare.

MassCare would like to thank HC Starck GmbH for their kind participation in this experiment. All measurements were made on their VG9000.