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A CEMENT BASE FOR THE HOT FILAMENT MASS SPECTROMETER SOURCE

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In the isotopic analysis of uranium and plutonium, difficulties were encountered in obtaining satisfactory adherence between the sample material and the tantalum ribbon filament upon which the sample material was deposited. In this connection, experiments were conducted in order to find a base material which would alleviate this condition.

Sauereisen cement, No. 1 paste, was found to be satisfactory in furnishing a porous, unglazed porcelain-like base upon which to deposit the sample material. The cement coating is approximately .002" thick.

The Sauereisen cement is thinned using Sauereisen No. 14 thinning liquid and painted on the tantalum filament with a fine brush. After several minutes of air drying, the filament is placed in a bell jar at about 5 microns of pressure where a current of 4-6 amps is passed through it. A temperature of about 1000°C is obtained at which the cement appears to "flow" into the tantalum ribbon. The temperature of the filament is then dropped to just below redness for several minutes then slowly (about 20 minutes) brought to room temperature. The sample material is then deposited upon this out-gassed Sauereisen cement base. The filament is returned to the bell jar and the sample evaporated to dryness by passing a smaller current through the filament.

In addition to providing a porous base into which the sample material penetrates, the presence of the cement appears to increase the ion emission from the sample. Six source filaments were prepared from normal uranium samples:

three with the cement base on tantalum ribbon, and three of equal amounts of sample material on bare tantalum ribbon. The samples ranged from 10 to 200 μg in size. In each case the emission current from samples deposited on the cement was stronger than those on the bare tantalum.

The cement base also prolonged the emission life of the samples. Sample material of the order to 50 μg that was deposited on bare tantalum ribbon was found to be completely evaporated off in about 2 hours of running time, while those on the cement base produced satisfactory ion beams for 7-10 hours. Plutonium samples of 35 μg have been run in the spectrometer for as long as 3 days, or about 20 hours of emission time, still producing usable ion beams.

The stronger emission currents and longer sample life obtained enables one to secure a large number of abundance ratios, and at the same time reduces the sample decay correction. Using the cement base filament, emission currents have been stable within 1% for at least one hour.

Inherent in the Sauereisen cement are other qualities that are desirable in hot filament source work. The cement is temperature resistant (up to 2000°F) and acid resistant which permits one to deposit acid solutions of the sample material onto it. The cement itself emits no interfering ions in the high mass range of analytical work. A Sauereisen blank filament was run in the spectrometer and the entire mass range from 0 to 300 was carefully scanned

for the presence of ions that could possibly interfere in the analysis of uranium and plutonium. The highest mass ion detected was mass 138, Ba^+ . This occurred only in a very small amount, possibly as an impurity in some of the lower mass cement constituents.

In our solid sample analyses, we have used Sauer-eisen cement as a sample base for several hundred spectrometer runs and have found it to be very satisfactory.