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MOUND LABORATORY

Operated By

MONSANTO CHEMICAL COMPANY

MIAMISBURG, OHIO

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Laboratory Director

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ELECTRODEPOSITION RESEARCH PROGRESS REPORT

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[redacted]

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~~GROUP 1~~
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Date: April 1-30, 1949

Prepared by: E. Orban

Distributed: JUN [illegible] 1949

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Problem	Man-Months
I. Plating of Polonium from Hydrofluoric Acid	
E. Conversion of Production Solutions to Hydrofluoric Acid Solutions	1
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IV. Miscellaneous	
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Total	5

ELECTRODEPOSITION RESEARCH

Group 1

W. Abel, R. Bell, E. Orban, J. Poppleton, and W. Raiff

ABSTRACT

A volatilization method has been devised for plating polonium on a platinum support so that it can be dissolved in hydrofluoric acid. Several test runs using selenium indicate that the method may be feasible.

The high density plating run in which 250 curies of polonium have been plated on a single gauze has been completed successfully.

A slide drier using a dry stream of air over the slides has given results that indicate that more refinements in the apparatus are required.

A special source in which the polonium was covered with gold leaf has been prepared.

DETAILED REPORT

I. Plating of Polonium from Hydrofluoric Acid Solutions

E. Conversion of Production Solutions of Polonium to Hydrofluoric Acid Solutions of Polonium - R. Bell

In view of the unfavorable results obtained in the previous attempt to convert production solutions of polonium to 1.0 N hydrofluoric acid solutions of polonium,* a different method has been devised.

It should be possible to eliminate completely the solution of polonium in 1.5 N nitric acid from the process by volatilizing the polonium directly onto a platinum foil or cup, and then dissolving the polonium off the cup with either a concentrated solution or a 1.0 N solution of hydrofluoric acid. The apparatus as shown in Figure 1 has been constructed with this objective in mind. The boat which contains the polonium on bismuth powder is slipped into the end of the quartz tube and the apparatus assembled as shown. The tube is put into a furnace as far as the platinum thimble so that the thimble will not over heat in spite of the cooling water running through the tube. The pressure on the inside of the tube is pumped down to about 100 microns.

Three test runs have been made using selenium in place of polonium. Table I shows the results that have been obtained.

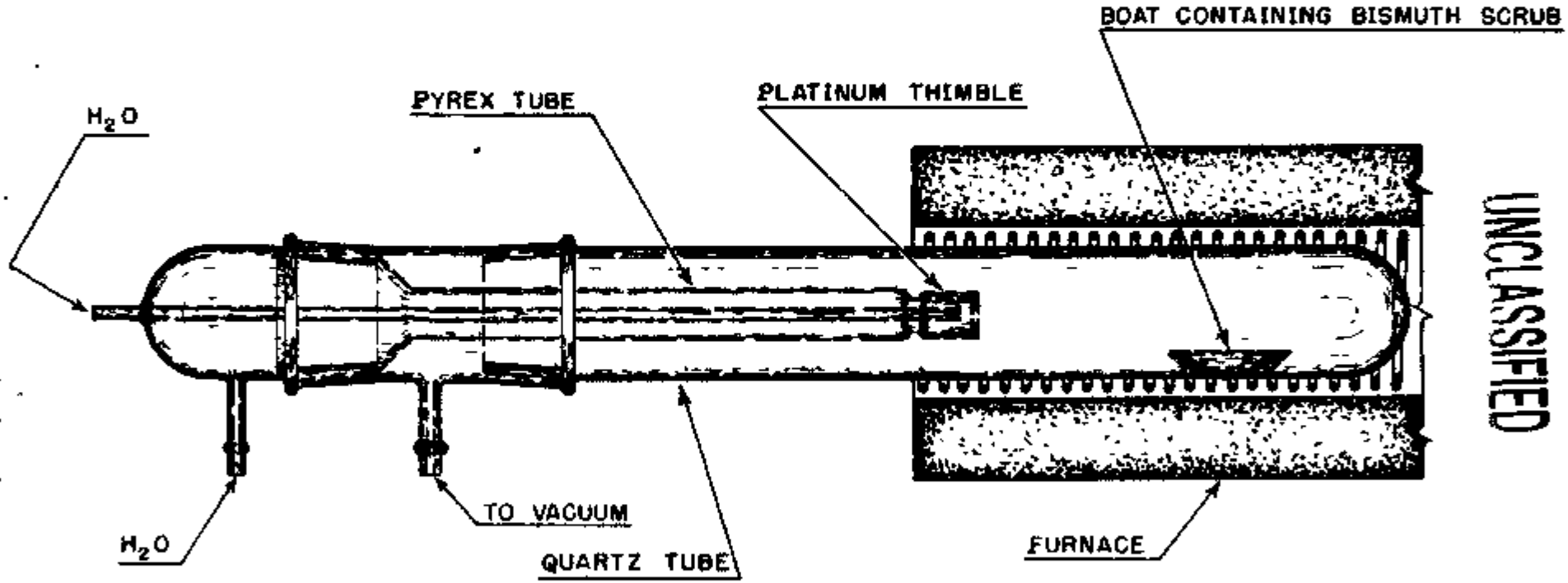
Table I

VOLATILIZATION OF SELENIUM ONTO A PLATINUM THIMBLE

	Run I	Run II	Run III
Selenium Originally in Crucible	0.0032 g.	0.0020 g.	0.0024 g.
Selenium not Volatilized	0.0019 g.	0.0004 g.	0.0016 g.
Selenium Volatilized	0.0013 g.	0.0017 g.	0.0009 g.
Per Cent Selenium Volatilized	40.6	85.0	37.5
Volatilization Temperature	186°	220°	220°
Pressure	0.12-0.16 mm.	0.07 mm.	0.07 mm.
Volatilization Time	10 min.	4 min.	2 min.

The results indicate that its method is feasible, but the correct conditions to have 95 per cent or better volatilization have not yet been found.

APPARATUS FOR VOLATILIZATION ONTO PLATINUM THIMBLE



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F. High Density Runs

The plating of 250 curies of polonium out of a 1.0 N hydrofluoric acid solution was completed successfully. A complete report on the problem has been issued,[2] but the data taken from the final plated gauze are presented again in Table II.

Table II

PROPERTIES OF POLONIUM PLATED OUT OF 1.0 N HYDROFLUORIC ACID

1.	Plated Area	14.8 sq. cm.
2.	Calorimetric Value on 2/17/49	254.9 curies
3.	Neutron Count on 2/16/49	9.6×10^4 n./sec.
4.	Neutron Count on 2/18/49	1.05×10^5 n./sec.
5.	Neutrons per Curie of Polonium on 2/16/49	376 n./sec.
6.	Gamma Count on 2/16/49	230.5 curies

The conclusions reached were that it would be feasible to plate even larger quantities than 250 curies of polonium on a single provided precautions were taken with regard to personnel protection from gamma and neutron radiations. This would entail revision of the remote control apparatus and radiation barrier over those used for this experiment.

IV. Miscellaneous

G. Design of Equipment - W. Abel

A slide drier, utilizing an air stream passing over the slides within an enclosed chamber, has been made. The entire interior is covered by a replaceable liner in order that the background may be kept at a minimum. When an analysis of a test slide shows that the background is rising the liner is replaced. The outgoing air stream is filtered through analytical filter paper and exhausted up the hood vent.

Results of the test runs made with water and using drierite to dry the incoming air are as follows:

Size of Sample	Time Required to Dry the Slide
2 lambda	2 minutes
100 lambda	20-25 minutes

Further modifications of the slide drier are needed to lower the drying time with large samples.

D. Special Sources - E. Orban

A request was received for a polonium source holding 20-50 millicuries of activity in an area of 1/2 x 1 cm. covered with a thin foil of metal that would not cut the range of alpha particles more than 1 cm.

A production size electrode 1 x 2 cm. in size was coated with Unichrome "Stop-off" paint except of the area which had to be plated. The foil was dipped into 60 ml. of 1.5 N nitric acid solution which contained 108 millicuries of polonium. An electrolysis was carried out with 10 ma. of current flowing for 6 hours during which time 53.6 millicuries was plated out.

A small amount of polonium stripped off when the "Stop-off" paint was peeled. It is estimated that about 40-45 millicuries remained on the foil.

The edges of the foil were painted with a little DuPont cement which had been diluted about ten times with acetone. A layer of gold leaf that reduced the range less than one centimeter was placed over the plated side of the foil. It was placed in a platinum can and packaged for shipment.

REFERENCES

1. Orban, E., Electrodeposition Research Group Progress Report, MLM-1[illegible] August 1-31, 1948.

2. Orban, E., High Density Plating of Polonium out of Hydrofluoric Acid Solution, MLM-310, April 21, 1949.

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