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MONSANTO CHEMICAL COMPANY - UNIT III

DAYTON, OHIO

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NEUTRON SOURCE PROGRESS REPORT

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NEUTRON SOURCE GROUP

Bentz, Birden, Hertz, Richmond, Schrantz, and Watrous

ABSTRACT

I. - Q-Beryllium Neutron Sources

A volatilization method of preparing sources is being worked out. Supported postum is covered with enough nickel to stop alphas. It is then placed in a container which can be tightly sealed and the postum volatilized onto the target. In one experiment 99.74 per cent of the postum was volatilized through 2.5 mils of nickel. In a second experiment the postum was covered with about 8 mils of nickel. Heating for a short period of time produced an inefficient source. This can probably be improved by longer heating.

II. Q-Boron Neutron Sources

The evaporation method of preparing neutron sources which has been succesaful in the preparation of fluoborate sources has been applied to a boron source. In a first attempt, source RW-4, 0.495 case of postum was deposited on one gram of -120 + 140 mesh boron powder. An efficiency of 49.9 per cent was obtained.

III. Q-Lithium Metal Neutron Sources

A Q-lithium source was prepared by dropping a platinum foil having 0.227 case of postum on it in a lithium-coated cylinder. Initially, the efficiency was 11.5 per cent. After melting and mixing the lithium, an efficiency of 42.1 per cent was reached.

DETAILED REPORT

I. Q-Beryllium Neutron Sources

Volatilization Method

A new technique for making neutron sources has been initiated. The method involves covering a foil with nickel to stop all alphas, placing in a beryllium container filled with beryllium powder, sealing with a heavy layer of nickel, and heating to about 1000°C. to volatilize and distribute the postum.

A micro foil (#4290) was obtained and covered with nickel (2.5 mils) until a zinc sulfide screen would not gloss. The foil was heated at 1175°C. for 30 minutes and 99.74 per cent removal of postum was obtained.

Another micro foil (#4235) was covered with about 8 mils of nickel and calorimetered. It contained 0.221 C. February 25, 1948. About 8 mils of nickel were laid down on it. This foil was enclosed in a beryllium sphere along with beryllium powder and sealed with approximately 16 mils of nickel. It was heated for 10 minutes to slightly over 900°C. and neutron counted. The count was 3.5×10^4 n./sec. February 27, 1948. The efficiency of this source (#JB-14) was very low, but more heating will probably increase it.

II. Q-Boron Neutron Sources

A Q-boron neutron source, RW-4, was prepared. One gram crystalline boron (-120 + 140 mesh) was placed in a platinum tube and wetted with 0.5 ml. of cold 1 N hydrochloric acid. This tube was placed in the apparatus used in preparing fluoborate neutron sources. The apparatus was heated to approximately 67°C. and was under a pressure of 435 mm. of mercury. No air was passed through the evaporation as contrasted to passing heated air through the tube in preparing fluoborate sources. It was found that the air stream would blow the dry boron out of the platinum tube. When the cold hydrochloric acid was evaporated, another 0.5 ml. portion of hydrochloric acid that had been dissolving postum from several micro foils was drawn into the evaporation tube. This was evaporated in the same manner. This process was repeated. Length of time of evaporation was 7.5 minutes. 17 minutes and 2 hours, respectively. The active boron was tamped and the bottom of the platinum can used as the tamp became the top for the source. The source was calorimetered and neutron counted.

Data on RW-4

Size of Neutron Source ----------	Height	0.9 cm.
	Diameter	1.07 cm.

Neutron Count Compared to Standard #49

Position #1	0.9 cm. ht. being vertical axis	2.01×10^5 n./sec.
Position #2	revolved 90° on vertical axis	2.04×10^5 n./sec.
Position #3	revolved 180° on vertical axis	2.01×10^5 n./sec.
Position #1	revolved 270° on vertical axis	1.98×10^5 n./sec.
Average of four positions		2.01×10^5 n./sec.

Calorimeter value 0.495 C.

Efficiency 49.9 %

III. Q-Lithium Metal Neutron Sources

A Q-lithium metal neutron source has been prepared by placing a platinum micro foil with postum in a hole drilled into a full cylinder of solid lithium. The source, LB-30, 0.227C. February 17, 1948, had a maximum efficiency of 42.1 per cent.

The source had a low efficiency of 11.5 per cent after just dropping the platinum foil with postum into the lithium-coated cylinder. Melting the lithium down on top of the foil increased its efficiency only slightly. However, with heating the cylinder above the melting point of lithium and mixing well by tapping, the efficiency was increased to 39.4 per cent. Another treatment of this sort brought the efficiency up to its peak, 42.1 per cent, while a further similar treatment caused a slightly lower efficiency. A mechanical vibrator has been designed to aid in mixing the sources with the hope of obtaining a more homogeneous mixture, thus increasing the neutron efficiency.

FUTURE PLANS

I. Q-Beryllium Neutron Sources

Continue preparation of sources by volatilization.

II. Q-Boron Neutron Sources

Continue preparation of boron sources by evaporation methods.

III. Q-Lithium Metal Neutron Sources

1. Prepare a source by volatilizing postum onto a lithium coated brass cylinder in an inert atmosphere and mixing same by heating and placing source in mechanical vibrator.

2. Prepare a lithium fluoborate neutron source.

3. Start cold work preparatory to making a sodium metal source.