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October 17, 1962

CENTRAL FILES

TRIP REPORT TO BUREAU OF MINES, RENO, NEVADA ON OCTOBER 9, 1962

S. Marshall

W. E. Shaw

OBJECTIVE OF TRIP

Information had been received that the Bureau of Mines Station was actively engaged in studying the electrowinning of uranium from UO_2. It was desired to see the equipment used and determine the status of the project.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1. A relatively simple cell that could be scaled up has been designed for the successful production of coalesced uranium from UO_2 feed at reasonable efficiency.

2. It is recommended that management take a long, hard look at the possibility of electrolysis becoming the technique of producing uranium; perhaps going as far as having Dr. Henry of the Bureau of Mines describe their process and comment on the possibility of scale up at one of management's meetings. — No.

3. The investigation of electrowinning of uranium from UO_2 has been terminated and two reports covering the period from inception to 1960 and from 1960 to date will be released shortly.

4. Investigations of electrowinning of the rare earth metals, electrowinning of molybdenum, tungsten and other so-called ferro alloys, as well as the electro-production of the phosphides are under way and are prime projects of this station. Physical metallurgy and other related activities, individually or in support of the prime projects, are also under way.

5. An offer was made by the head of the station to provide whatever support was necessary if we desired to enter the electrowinning field. This offer went so far as to permit use of their facilities to undertake whatever studies we deemed necessary using either our men or their men or any combination feasible.

6. A technique for solid state purification of metal is being developed and shows some merit.

BACKGROUND FOR TRIP

The Technical Division of the National Lead Company of Ohio has been charged with the responsibility for keeping abreast of the developments in the electrolytic investigations concerned with uranium. The electrowinning of uranium from UO_2 has been investigated by the Reno Station of the Bureau of Mines. The work has been under way since approximately 1957 and as yet no reports have been issued. We have recently become aware of this work and were desirous of obtaining first hand information of the project. Contacts were made with the head of the project, Dr. Tom Henry, and a visit was arranged.

PERSONS VISITED

Mr. Ed Graham - Head of Station
Dr. Tom Henry - Project Manager
Mr. Don Baker - Project Manager
Mr. Don Kesterke - Project Leader

DESCRIPTION OF TRIP

Dr. Tom Henry welcomed me. He described his job as heading the project group preparing rare metals. He has been on this job some two years, having taken over from a Mr. Knickerbocker. They have prepared lanthanum, yttrium, cerium as well as uranium by the same basic techniques. Dr. Henry's background was in titanium metallurgy and prior to coming to Reno he was employed at Boulder City.

Don Kesterke, who is a group leader working for Dr. Henry, came in and we discussed the cell and process used for electrolysis of uranium.

The best results were obtained in an 8" diameter carbon crucible made of National Carbon AGX grade. A partially slotted cylinder was set up inside this crucible. The UO_2 was fed into the annulus so formed. (See sketch).

The salt bath used was a ternary mix of:

$$UF_4 : \begin{matrix} BaF_2 \\ \text{or} \\ CaF_2 \end{matrix} : \begin{matrix} LiF \\ \text{or} \\ MgF_2 \end{matrix}$$

Two anodes 1-1/4" in diameter and immersed 3" were used and two cathodes 0.45" in diameter stepped down from 0.75" and also immersed 3" in the bath were also used.

Heat was supplied by a carbon resistor in the base of the crucible in addition to the heat supplied by the electrolysis. The temperature of the bath was maintained at 1300 to 1350°C.

In operation the cell required 15-16 volts DC at 400 amps, the efficiency was calculated as approximately 30%. The cell was maintained under a helium atmosphere in a large cooled glove box. UO_2 was fed into the annulus of the cell at a predetermined rate and adjusted by following the composition of the atmosphere and the voltage-amperage relationship. Six lbs. of U were produced in approximately an eight-hour period.

There have been some difficulties but the process is deemed a successful one and is now being terminated. The attitude was expressed that they feel their work is complete when the feasibility of a process is shown. If it is of commercial value, the transition to a producing unit is the job of the engineers of the group planning to use the process.

Reports are being prepared; the first report which should be published shortly deals with the work up to 1960. This report has caused some difficulty with MCW and I gather they are not on very friendly terms. A second report should be forthcoming shortly and this will be the wrap-up of their work.

Some work was being done in the laboratory on solid state migration of impurities in metals. A rod of relatively pure metal was placed in a furnace and a potential applied to the ends of the rod. The impurity migrated to the end of the rod. An example of the migration of radioactive tagged iron in cerium was shown. The results were quite startling. The curve of count vs. distance showed a uniform level prior to treatment and a very sharp spike quickly dropping to well below the original count with only an eight-hour treatment. This may have possibilities if applied to ingots.

After lunch I talked with Mr. Don Baker who is working on electrolysis of tungsten and molybdenum and similar so-called ferro alloys, also some of the phosphides.

In discussion with Mr. Graham, after a tour of the facility, we learned that there had been contacts with George Rennich of Oak Ridge AEC. There has been an offer of financial support from Oak Ridge AEC even though the Reno Station did not desire this financial support.

Apparently some contacts were made approximately in 1957 by people concerned with electrowinning UO_2. The Bureau prepared a project proposal and asked for evaluation by the AEC. They received no response and upon re-inquiry were offered $40,000 from the Oak Ridge AEC to support such a project. Reno did not want the money. They had their own and all they wanted was an evaluation. Finally the financial offer was accepted so that they could get an evaluation of the project. MCW was to be the coordinating or liaison agent with Arch Ruehle serving as the contact. An agreement was reached with MCW regarding the routes to be followed. MCW would use the C-UO_2 compact technique and Reno would stay away from that procedure. The relations recently with MCW have been strained and this may have contributed to their termination of the project.

The works of Dr. Henry and Mr. Baker are becoming quite recognized in the AEC. They have been asked to evaluate the plutonium electrolysis program; they soon will visit Argonne and Hanford to discuss electrolysis programs or work in process.

MISCELLANEOUS COMMENTS

The attitude toward releasing information was very cooperative. It was stated many times during the visit that their job was to supply this information to all concerned parties. Some wonder was expressed by the personnel at the Bureau of Mines Station about the lack of inquiry from Fernald after they had learned of our function in the uranium chain. They were most cooperative and promised to keep us informed regarding their future developments. They are engaged in investigating production and physical properties of the rare earth metals. They have no desire to bring these processes or metals to commercial utilization but would depend on the commercial producer to attempt this fruition.

Some of the physical testing, both destructive and non-destructive, would be of interest to our metallurgy personnel. These tests involve, besides the more usual tensile, charpy and hardness tests, tests of cryogenic properties and utilization of X-ray techniques for investigation of metallurgical behavior.

COMMITMENTS

None.

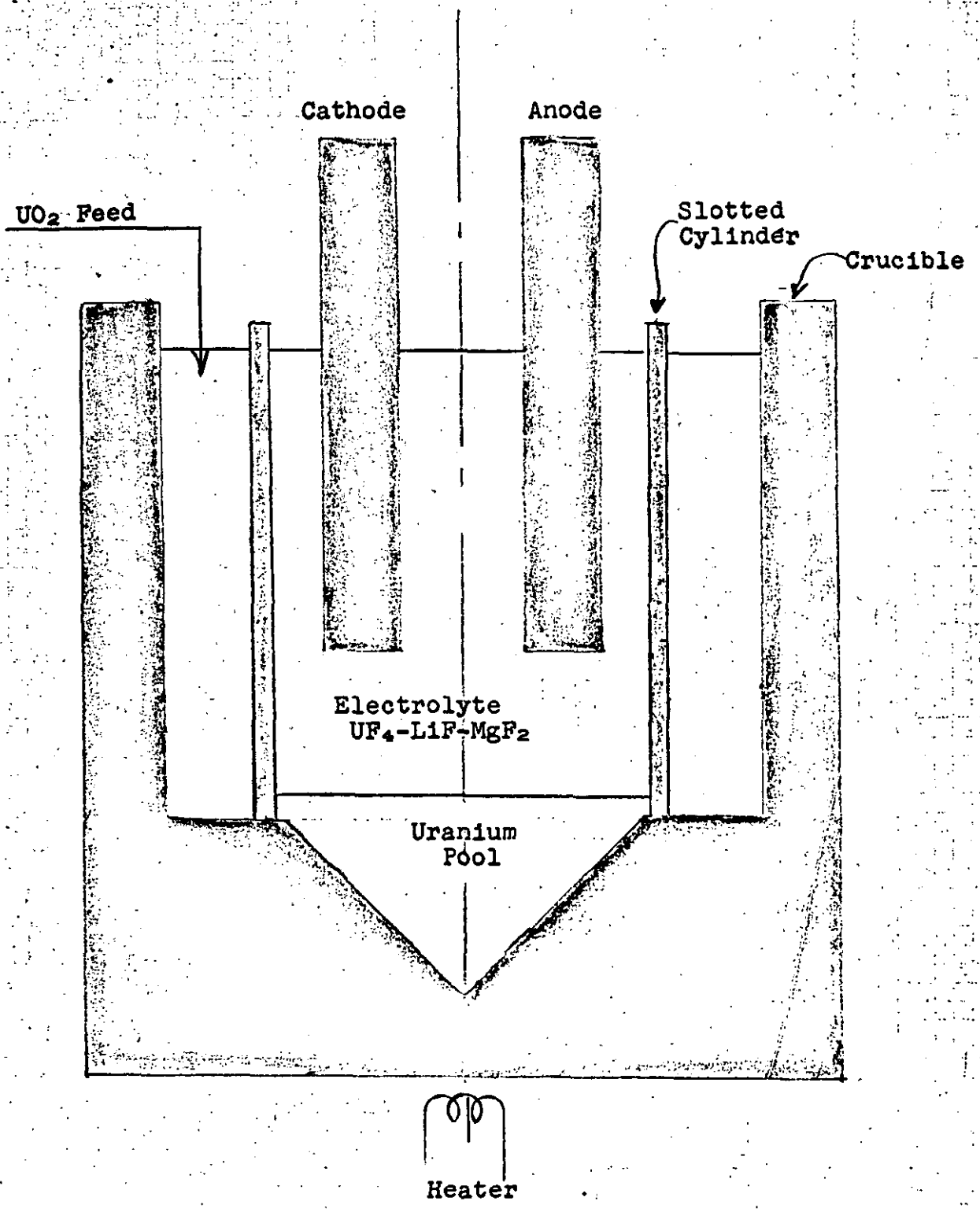
ORIGINAL SIGNED
BY W. E. SHAW

W. E. Shaw

WES/rb

cc: J. H. Noyes (3)
C. E. Polson
G. J. Morgan

BUREAU OF MINES ELECTROLYSIS CELL



NATIONAL LEAD COMPANY OF OHIO
FERNALD, OHIO
DEPARTMENT:

SCALE	None
DATE	Oct. 17, 1962
CHARGE	
DRAWN BY	Shaw
APPROVED BY	

SK. NO.