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MONTHLY PROGRESS REPORT

ON

FUEL ELEMENT DISSOLUTION STUDIES

May & June, 1958

Nuclear Engineering Department
Brookhaven National Laboratory

Upton, New York

AEC Budget No. 4301

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Brookhaven National Laboratory

M E M O R A N D U M

DATE: July 17, 1958

TO: C. Williams

FROM: L. P. Hatch, J. J. Reilly, W. H. Regan

SUBJECT: Fuel Element Dissolution Studies During May and June

Fluid Bed Hydrochlorination

A sample of a non-irradiated, zircaloy clad UO_2 fuel element has been decladded almost completely in fluidized bed hydrochlorinator. No filters of any kind were used in this experiment for de-entraining UO_2 particles, since it was surmized that the UO_2 core would remain relative intact. The total sample weight was 47.9 gms and it had a surface area of 44 cm^2. The average reaction rate based upon the original surface area was 600 mgms cm^2 hr. The final sample weight was 12.8 gms. The recovered plate of UO_2 appeared to be intact with no apparent dimensional change, although scaling was evident. The surface area of the recovered UO_2 was 25 cm^2 out which about 3 cm^2 appeared to be covered by a thin layer of unreacted cladding material. A sample of $ZrCl_4$ product containing 10.3 gms of Zr contained 0.0253 gms of uranium; projecting this figure for the total amount of Zr reacted and assuming the product is homogeneous gives a value of approximately 1.2% of the total U present carried over with the product. A total of 2.06 gms of uranium was recovered from the reactor sand by leaching with HNO_3. There was a small amount of insoluble black material recovered from the sand which was shown by spectrographic analysis to consist principally of silica.

As previously reported a sample of a zircaloy clad, Uranium-Zirconium alloy fuel element was hydrochlorinated in a system which included a sand filter for de-entraining Uranium particulate matter carried over with the $ZrCl_4$. Analytical results have shown the amount of U which passed through the sand filter is at least as much as that which was recovered from the sand by leaching with nitric acid. Actual amounts were 3.17 mgms of uranium recovered from the sand filter while the gas scrubbing solution contained 3.4 mgms of uranium. Future experiments with alloy type fuel elements will be concerned with determining the total uranium material balance.

Several preliminary experiments involving heat transfer between a heat source (500 watt strip heater) and a fluidized sand bed expanded about 20% over its settled volume gave values of 50-60 BTU/hr x ft^2 x F for heat transfer coefficients.

Equipment has been designed and is now being built for investigating the possibility of using an inert fluidized bed for heat removal in the highly exothermic reaction between metallic uranium and fluorine.

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