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TITLE

REACTIVITY OF UO3

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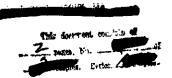
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March 25, 1955



## REACTIVITY OF UO3

The term "reactivity" when used in connection with the properties of UO2 is of reaction rates and has meaning only when the basically a reparticular reactions involved, and the conditions under which the reactions are carried out, have been specified. A reactivity term is used at Malinkrodt and Fernald which is applicable only to the sequence of reactions involved in the reduction of UO3 to metal. The "reactivity" (or "reactivity ratio" as it is sometimes called) which is of interest at HAPO, is a relative measure of the extent to which the UO, may be converted to UF14 in the reduction and hydrofluorination steps of the process used in the preparation of the uranium for introduction into the diffusion process at Oak Ridge and Paducah. It is a completely arbitrary unit, expressing the ratio between the per cent conversion to UF $_{ij}$  of a sample of Hanford U $\theta_{ij}$  and the per cent conversion to UF4 of a primary standard sample of UO2, originally obtained from the Malinkrodt Chemical Works, when reacted in accordance with a standard analytical procedure. The primary standard was selected from a lot of material which was observed to give good conversion to UFh. In practice, the determination is made from secondary standards, which are currently supplied by Oak Ridge. The procedure in the laboratory is to take aliquots of the unknown and of the standard, reduce each to UO2, then to react the UO2 with HF, each step being carefully controlled. A quantative determination of the UFh is made for each sample and the per cent conversion of the US to Is is calculated. The reactivity is then reported as

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Reactivity = % conversion to UF4 of unknown sample % conversion to UF4 of standard sample

Thus samples which react to a greater extent than the standard sample may have reactivities greater than unity.

At Oak Ridge, the uranium trioxide is reduced to UO2 by heating in an atmosphere of hydrogen on vibrating trays. The UO2 thus produced is then #converted to UFh ("green salt") by further heating in an atmosphere of hydrogen fluoride. These steps are much less expensive than the subsequent step of fluorination to UF6 in an atmosphere of fluorine, but the purity of the UF4 has a marked effect on the rate at which conversion to UFG takes place, and on the quantity of fluorine gas required to convert all the uranium present to UF6. For example, UO3 of poor reactivity may yield UFh containing substantial amounts of UO2F2, a compound which may Equanow: UozFz +452 - UF. be converted to UF6 when heated in a fluorine atmosphere hour which in the process may require up to 4 times as much fluorine as UFh, the fluorine costing approximately 10 times as much as HF. The economic advantage of UO2 of high reactivity is immediately apparent and it has been stated that each increase in reactivity of 0.1 (in the reactivity range of 1.0) would result in savings at Oak Ridge of \$100,000 annually.

Many factors such as particle size, crystalline form, amount of impurities, water of crystallization, etc., are believed to influence the reactivity of the UO3.

The U03 can be made more reactive by converting it to the monohydrate, and a plant for this purpose was designed but never constructed. Occasionally, samples of ordinary UO2 are run against a monohydrate standard which Tis about twice as reactive as the conventional standard). This method is used only as a

tool in exemining very reactive material

Design & Development

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