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Contract AF(30-1)-2789
CMLM-5827

August 26, 1963

Mr. L. M. Haring

M. A. DeFrescanta & S. B. Caplow

cc: Messrs.
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SWAP-33 Fuel Development Summary
for August, 1963

1. Ten percent enriched, alloyed carbide powders, $(0.95\text{U}_{0.05}\text{C})$, have been prepared for fabrication into pellets that are intended for irradiation. The process used is that which has been recently developed for the fabrication of irradiation specimens containing 5, 17 and 29% ZrC.

2. Construction of an all metal uranium nitride pilot synthesis rig is proceeding satisfactorily. Completion is expected in the next period. At that time work will begin on a program to scale-up the synthesis techniques that were developed for the glass laboratory apparatus, to ones suitable for larger scale production.

3. The HREAC adsorption analyzer, used for surface area measurements, was installed and is presently being calibrated. This apparatus will be used for relating the sintering performance of UC and UN to the powder characteristics. Attempts are also being made to determine the effect of pellet density upon the total surface area. It is expected that in this way, some correlation will be achieved between the sintered density of irradiation specimens and the fission gas release.

Fabrication has been completed of 20 tungsten-lined pins containing uranium nitride. The pins are scheduled for lithium encapsulation and 2200F compatibility evaluation. The tungsten contained in the pins was

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FINAL	4	12-1-81
DETERMINATION	4	12-1-81

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To: Mr. L. M. Baring

applied by the vapor deposition process (3 mils thick) thus providing the first opportunity to evaluate the out-of-pile compatibility performance of this barrier.

5. Lithium encapsulated pins, both sound and defected, containing stoichiometric UC, (W), Co-1 Zr alloy have been removed from test after 2500 hours at 2200°F. The specimens are in process of being evaluated; first indications are of satisfactory performance for the sound pins and evidence of U diffusion into the cladding of defected pins.
6. Testing continues of Ta-lined pins containing hyperstoichiometric UC with approximately 6,000 hour specimens due to be removed in the next period.
7. Results of couple-type compatibility tests of hyperstoichiometric UC in contact with unalloyed columbium and also with Co-1 Zr alloy indicate that the zirconium is the agent primarily responsible for the absence of protective carbide diffusion layers on materials in contact with $UC_{1.1}$. A possible explanation for the sometimes good performance of UC in direct contact with clad materials (no barriers) is that high interstitials tie up the zirconium - effectively preventing it from acting as a sink for carbon from the fuel, thus allowing protective carbide layers to form which slow down continued reaction and also the diffusion of U into the clad material.
8. Evaluation was concluded on the 5,000 hour UC, (W), Co-1 Zr alloy compatibility couple in which 1 mil of W foil was used as a barrier. Analyses confirmed the presence of U, and a U-Zr precipitate, in the Co-1 Zr alloy to a depth

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To: Mr. L. M. Raring

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of approximately three mils. It is considered that the thicker barriers of tungsten (i.e., 3-5 mils), such as are being used in the pin tests previously mentioned, may be adequate as a barrier for the required time. Alternate approaches are also being considered.

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