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DPW-56-157

SR/H-768

- 1-2 - D. C. Martin, BMI
- 3 - E. J. Hagelston
- 4 - E. Worthington - L. C. Evans
- 5 - P. M. Burns - J. R. John
- 6 - W. J. O'Leary
- 7 - C. C. Woodhouse
- 8 - W. File
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- 10 - J. W. Croach - P. H. Fermar
- 11 - TIS File

ALL *ADD* *2/4/59*
Name Title Date
J. Banick *AED CO* *2/4/59*
Mr. D. C. Martin
Battelle Memorial Institute
505 King Avenue
Columbus, Ohio

February 21, 1956

~~This document consists of 3 pages
No. 6 of 11 Copies Series A.~~

Dear Mr. Martin:

I have your letter of February 15, 1956, containing proposals for a continuation of your program of research and development on new fuel elements, with an outline of the general scope that this program would comprise. While we are in general agreement that work should be continued along the three general lines you propose, we would like to have your proposals amended in accordance with the paragraphs below.

I understand from Dr. O'Leary that in telephone conversations with him you indicated the changes are agreeable. Will you, then, kindly send us the necessary contract forms to cover this work so that we may submit them to the Atomic Energy Commission with our recommendation for approval.

Extrusion Cladding of Flat Plates

Your letter proposes continuation of work on the extrusion cladding of flat plates. We agree with attention to improve uniformity of aluminum flow and that it is desirable, as you point out, to provide integrally extruded end plugs and to reduce the extrusion pressures. In view of recent results in the work being done for us at Moczlik, we believe, however, that your program should emphasize employment of higher temperatures as a means of reducing pressures.

In contrast with your work employing around 1000°F and resulting in pressures of 35,000 lbs. at very slow extrusion speeds, the work at Moczlik has been carried on at temperatures up to 1100-1150°F. Aluminum appears to handle quite easily at the 1100-1150 degree temperatures and high strength bonds are obtained.

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Reviewing
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J. Banick

C. J. Banick, AED Class Officer

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FOR BETTER LIVING THROUGH CHEMISTRY

Mr. D. C. Martin
February 21, 1956
Page No. 2

DP-56-157

Extrusion speeds are normal. The container and dies have stood up very well at the higher temperatures. The Moczik results lead to our suggestion of employing up to 1100-1150°F unless your information about the dies and containers that you have indicate they will not operate in that range.

With the above modification of your proposal we believe that studies on the extrusion cladding of flat plates outlined in your letter of February 15 should be continued for twelve months within the expenditure of \$63,000, including \$3,000 fixed fee.

Internal Cladding of Tubes

The initial work done to clad tubes internally by plug drawing has shown so little promise of eventual success that we do not wish at this time to support this approach further. The tube expander, on the other hand, has indicated the possibility of internally cladding small bore tubes (2 inches I.D. or less). The bond strengths, however, on the two tubes so far clad have been weak and spotty (0 to 12,000 psi) and do not provide a basis for the 12-month, \$31,500 program proposed. The bond results point to the necessity of cladding at a higher temperature, or for pressurizing for a longer time at high temperature, or both. We propose, therefore, that funds now be appropriated only for three more trials, to be made with the tube expander, to study the possibility of improved bonds at higher temperatures, (one at 1000°F, one at 1050°F, and one at 1100°F). Since the equipment for this work is already on hand, I propose that the sum of \$5,000, including fixed fee, be allocated for these trials to improve bonding, which trials could hopefully be completed within two months. If bonding is substantially improved, we should then like to review this subject again and determine what further course the project should take.

At our January 26 meeting you mentioned that in the case of full length tubes there might be serious material problems with the mechanism to drive a tube expander at high temperatures. As I recall, you proposed to have calculations made to determine whether this seemed likely to be a major problem. We assume that you have encountered no problems at 950°F for two-foot lengths of tube. We would like to have calculations made to see how the materials situation appears for 14-foot lengths of tube at temperatures up to 1100°F.

Mr. D. C. Martin
February 21, 1956
Page No. 3

DPW-56-157

Aluminum-Uranium Alloy

In view of the obvious advantages to be gained by having more uranium and less aluminum in a uranium-aluminum fuel element and the favorable results obtained at BMI in making 30 w/o castings, we feel that investigation of the uranium-aluminum alloy system should continue to establish a maximum practical uranium content. We agree that the work outlined in your letter of February 15 on making non-segregated, non-porous alloy castings should be carried out. On account of the fact, however, that other qualities than the uniformity and soundness of castings may limit the maximum amount of uranium which it is possible to have in uranium-aluminum alloys for use as reactor elements, we should like to amend your proposal to include also investigation of the following for those higher uranium content compositions for which you are successful in getting satisfactory castings. .

- (1) Corrosion resistance in megohm water at 100 and 150°C.
(Corrosion resistance of the currently used 15 w/o uranium alloy is of the same order as that of 2S. Corrosion resistance of this order is desirable by contrast with that of 100% uranium. Our present information would indicate that the corrosion resistance might limit the uranium content to not much over 30 w/c, but the results you have obtained in avoiding segregation in such alloys may raise this limit).
- (2) Diffusion rate of uranium from the alloy into 2S aluminum as sheathing. (Rate of diffusion should not be significantly greater than that of 15-20 w/o alloy).
- (3) Values of physical properties, such as brittleness or hardness, which might interfere with current methods of fabrication into slug or tube type fuel elements, or with suitability for irradiation as regards mechanical properties.

We agree with your proposal that expenditures for uranium-aluminum alloy during the next twelve months should be in the amount of \$31,500, including a fixed fee of \$1500.

Very truly yours,

ATOMIC ENERGY DIVISION

John C. Woodhouse
John C. Woodhouse
Technical Division

JCW/jss

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