EQUIPMENT AND EXPERIMENTAL PROCEDURE

Extrusion Tooling

The major components of the hydrostatic-extrusion tooling used during this report period were previously described.[1, 2, 3, 4, 5, 6]* Modifications in die-orifice design are discussed in the appropriate section of this report. The stem-seal arrangement used in the 400 and 500 F trials was described in Interim Report VII.[5]

The die-seal arrangement, described in Interim Report VIII[6] which consisted of a single O-ring located in the base of the die, was evaluated with several dies. At room temperature and at pressures of 240,000 psi, no leaks occurred with this seal arrangement. Sealing was not achieved at 500 F with a PTFE O-ring. Other O-ring materials will be evaluated for use at this temperature.

All billets are 1-3/4 inch in diameter x 6 inches long plus a 45-degree conical nose, unless otherwise noted.

Materials

A number of new materials were extruded during this report period. Description of these materials is as follows:

(1) Dispersion-hardened sintered-aluminum-product (SAP)

(a) Composition: 99.999% pure aluminum plus a 6 wt % dispersion of Al_2O_3.

(b) Condition: 80 to 85 percent of theoretical density and yield strength of 35,000 psi.
(Supplied by Oak Ridge National Laboratory, Oak Ridge, Tennessee, and produced on AEC activity No. 0440-02041.)

(2) Ti-6Al-4V prealloyed powder

(a) Composition as supplied by the vendor:

Ti	Bal	Fe	900 ppm	Mn	11 ppm
Al	6%	C	200 ppm	W	10 ppm
V	4%	B	<0.1 ppm	Cu	10 ppm
H	50 ppm	Co	<0.2 ppm	Si	68 ppm
N	60 ppm	Cd	<0.2 ppm	Hf	60 ppm
O	1800 ppm				

*References are listed at the end of the text.

(b) Condition: The powder was characterized as having 90 percent of the particles between -100 and +325 mesh and the balance of the material at -325 mesh.
(Supplied by Penn Nuclear Company, Penn, Pennsylvania)

(3) Alloy 718

(a) Composition as provided by the manufacturer:

	Max %/Min %		Max %/Min %		Max %/Min %
C	0.10/0.03	Cr	21.0/17.0	Ti	1.15/0.65
Mn	0.35/ --	Ni	55.0/50.0	Al	0.80/ --
Si	0.35/ --	Co	1.0/ --	B	0.006/ --
P	0.015/ --	Cb+Ta	5.50/5.00	Cu	0.10/ --
S	0.015/ --	Mo	3.30/2.80	Fe	Bal

(b) Condition: Material was received in the form of hot-worked bar stock in the solution-treated condition; hardness was 16 R_C.
(Supplied by Latrobe Steel Company, Latrobe, Pennsylvania).

(4) A-286

(a) Composition as provided by the manufacturer:

C	Mn	Si	Cr	Ni	Mo	Ti	Al	B	Fe	V
0.05	1.40	0.40	15.00	26.00	1.25	2.15	0.20	0.003	54.00	0.30

(All values are in percentages.)

(b) Condition: The material was received in the form of hot-worked bar stock in the solution-treated condition; hardness was <10 R_C.
(Supplied by Allegheny Ludlum Steel Corporation, Pittsburgh, Pennsylvania).

The remaining materials evaluated during this report period were detailed in Interim Reports Nos. I, VI, and VIII.[1,5,6]

Lubricants, Coatings, and Fluids

Table 1 lists the billet lubricants used in this report period. No new lubricants were evaluated but investigation of stearyl stearate (L52) with 7075 aluminum was continued at higher ratios. Lubricant L38 (PTFE) was the billet lubricant used with all of the TZM, beryllium, and superalloy billet materials.

Coating C3 was applied to all the Ti-6Al-4V titanium billets before lubrication. It was evaluated for the first time at 400 F.