COLD HYDROSTATIC EXTRUSION OF BERYLLIUM

Cold hydrostatic extrusion of beryllium rounds was initiated during this report period. A single attempt was made, thus far, to extrude beryllium under the following conditions:

Billet diameter	1-3/4 inches
Extrusion ratio	2.5:1
Area reduction	60 percent
Die angle	45 degrees (included)
Stem speed	6 ipm
Fluid	Castor oil
Billet lubricant	L17

	Extrusion Pressure, 1000 psi			
	Breakthrough		Runout	
Trial	Stem	Fluid	Stem	Fluid
377	142.5	137.5	134.0	129.0

Some stick-slip occurred during runout although the shape of the extrusion curve generally indicated good lubrication. Approximately 8 inches of extruded rod was obtained. Although the extrusion exhibited transverse surface cracks, the cracks were relatively small and the extrusion remained in one piece. The extrusion die used in this case was designed to effect a gradual release of the elastic stresses present in the extrusion on exiting from the die land. Additional trials will be made with dies with further modifications, and also under other extrusion conditions believed to reduce the tendency toward cracking.

In addition to this effort on extrusion of beryllium billets, work has been initiated on the fabrication of beryllium wire by hydrostatic extrusion-drawing. In this Battelle-developed process, hydrostatic pressure is exerted on the workpiece on the entry side of the die and draw stress is applied simultaneously to the workpiece on the exit side of the die.

The aim of this portion of the program is to determine the technical feasibility of producing beryllium wire down to a target diameter of 0.001 inch. The starting wire diameter will be 0.020 inch. Beryllium wire originating from both powder and cast ingot will be investigated in the study. The necessary dies and auxiliary equipment are being purchased or constructed. Brush Beryllium Company has been subcontracted to provide portions of the starting wire stock and to evaluate the fabricated wire from the standpoint of mechanical properties, dimensions, surface quality, microstructural characteristics, and deformational characteristics. Mr. H. Ll. D. Pugh, Visiting Professor at Case Institute of Technology is assisting in this portion of the program as a consultant.

FUTURE WORK

During the next interim report period it is expected that work will continue on development of lubricant systems for the cold hydrostatic extrusion of 7075 aluminum and

Ti-6Al-4V alloy. Also, work will continue on the hydrostatic extrusion of beryllium, shapes, and wire. Work will also begin on hydrostatic extrusion of selected refractory metals and alloys. In addition, it is expected that the design modifications of the elevated temperature-high pressure transducer will be completed and hot hydrostatic extrusion trials at 500 F will begin.

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