ABSTRACT

Development of the Manufacturing Capabilities
of the Hydrostatic Extrusion Process

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The purpose of the present program is to develop the manufacturing capabilities of the hydrostatic extrusion process. Specific applications to be studied are fabrication of wire, tubing, and shapes from relatively difficult-to-work materials such as refractory-metal alloys, high-strength steels and aluminum alloys, titanium alloys, beryllium, and other selected materials.

Investigation of critical process variables for the cold hydrostatic extrusion of 7075-0 aluminum, AISI 4340 steel and Ti-6Al-4V titanium alloy was continued during this report period. Several experiments on wrought TZM molybdenum alloy were conducted in which the effects of extrusion ratio, billet lubricants and die design were evaluated. Further work on the extrusion of beryllium in billet and wire form is reported. Important developments in the program are given below.

(1) Stick-slip was eliminated in the extrusion of 7075-0 aluminum at ratios up to and including 40 : 1 and at ram speeds of 20 ipm. At 20 : 1, this was achieved by a new lubricant, 20 wt % MoS_2 in stearyl stearate (L53). At a ratio of 40 : 1, a special billet nose design was effective in eliminating stick-slip.

(2) Tandem extrusion of 7075-0 aluminum billets with a counterbored joint was achieved without separation or any discontinuity in the extrusion pressures.

(3) Several very effective lubricating systems have been developed for AISI 4340 steel.

(4) A 4-1/2-inch length of high-quality Ti-6Al-4V tubing 0.663 OD x 0.030 wall was produced from tube stock having a wall thickness of 0.069 inch.

(5) A simplified die-seal arrangement eliminated the need for a metal seal ring and was effective in containing fluid at high pressures.

(6) In several extrusions of a TZM molybdenum alloy, circumferential billet cracking was eliminated with a special die design. Only a few longitudinal cracks occurred on the extruded section.

(7) A 5-foot length of beryllium wire was produced by hydrostatic extrusion-drawing at a reduction of 25 percent.

PUBLICATION REVIEW

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