TRIP REPORT

Astronuclear Laboratory

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Unclassified

Trip to: ALCOA Extrusion Plant,
Lafayette, Indiana

Date of Trip: 20 January 1972

PURPOSE OF TRIP: To observe the extrusion of 8 BATH powder compacts to 2-1/2-inch bar per P. O. 59-FZL-22836-M (NERVA)

SUMMARY:

The 8 billets were extruded as called for in the P. O. Judging from visual inspection of the product, results were similar to those of previous extrusion runs. The first bar extruded was very badly "pine-coned" and had no usable portions; in previous runs, the first bar was also very poor. In this case it is thought that the extrusion speed was too low. For the next bar, the speed was increased, and there was little pine cone at the nose end of the bar, but blistering occurred near the tail end. The extrusion speed was gradually reduced in succeeding extrusions, and a reduction in blistering was noted, but this was accompanied by increasing length of pine cone at the nose end. The cause of blistering is not known, but ALCOA personnel stated that on other aluminum alloy extrusions, blistering (somewhat different in appearance) was associated with the use of a grease lubricant in the die and in such cases it appeared near the tail end of the extrusion. Grease is used with the BATH because of severe galling tendency of the BATH as it passes through the die. Another possibility to be considered is that high extrusion speed causes temperature rise in the billet until it is sufficiently overheated to cause some hydrogen to be released from the TiH_x . There is some evidence to indicate that this is unlikely, but further examination will be made of these blisters (which have also been observed previously in BATH extrusions).

The surface of sound portions of the bars showed an apparently superficial crazing, which ALCOA said they have observed in other aluminum extrusions when the speed was too high. This has been seen in some BATH extruded previously.

Except for the variation in extrusion speed noted above, all material and conditions were nominally identical for the 8 billets. Data records obtained will be supplied by ALCOA.

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On the basis of what has been observed so far, it is recommended that in future runs, an attempt to improve the yield of sound material should be made by (1) extruding longer billets (20" instead of 12"); (2) trying a non-grease (dry) lubricant in the die; and (3) reducing the extrusion speed after the first few feet have been extruded and sound material is emerging, so that temperature rise will be minimized.

It is also recommended that WANL PDS 30259 be revised to allow at least a 1/8-inch radial clearance between the billet and the die liner (both cold), at least for billets of this size (11"). (It might be further noted that the density requirement for the powder compacts appears to be too high, i. e., it is not consonant with the required conditions of pressing and composition.

The ALCOA Lafayette contact for this work was Frank Doherty (317-447-4141 - ext. 347).

SIGNATURE

J. B. McAndrew

APPROVED

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