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By Authority of W.A. Smyth,

PR-24, 2-2-94.

By Jessie Mally, 4-20-94.

Verified By Dej. Phillips, 4-20-94.

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9-47

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HW-7-3424

FEBRUARY 11, 1948

800 AREA

Monthly Report for January

C

Extrusion and Machining

O

Extrusion runs were made on January 4, 10, 11, 17, and 23. The improved red handling equipment continued to work well, producing superior rods to the former arrangement. Some red straightening on the run-out conveyor is still required, particularly on the leading end, to eliminate kinked conditions. Further improvement is required in red handling from the coaming tank to the scales, abrasive cutter, and out-gassing containers, so that rods left reasonably straight after extrusion and coaming will not be bent during manual handling.

P

Improved container cleaning is needed and has been recommended; there are several possibilities. A cleaning brush arrangement has been suggested which looks promising. The use of an air lance has improved conditions. Better fitting dummy blocks and improved control of temperatures should reduce formation of fins, wear of containers, and tendency for oxide and scale to adhere to the liner walls.

Y

An improvement to butt shear arrangements has been proposed and given preliminary trials. This will make possible several desirable things: better separation of butts from dummy blocks and fins from butts, less battering of dummy blocks and therefore improved fit to containers, and, if the improved stump shear is moved on the run-out conveyor, the shearing can be done simultaneously with container cleaning allowing more time for the container cleaning operation and improved container conditions.

Improvement in billet handling facilities has been proposed, following the general principle utilized on an experimental basis early in 1946. This is expected to reduce exposure time for hot billets between furnace and press from about 45-50 seconds to about 10-15 seconds, with a resulting reduction in tendency to build up oxide on the container surface. There are other prospective advantages, such as more convenient opportunity for billet brushing before extrusion.

Investigation is being made of a hard facing alloy (HML-0-001) as a possible substitute for Stellite or Stellite on dummy blocks and dies. Indications so far are favorable.

Reports were issued on trips by a Technical representative to Ames, Chambers Works, and Metal Hydrides in connection with chip cleaning, bagging, and re-casting.

A procedure is being prepared for cleaning and bagging of machining scrap.

A recommendation has been made for further study and experimental work on prevention of wavy and improved dimensional stability by cooling rods through alpha-beta-alpha phases during out-gassing.

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2-11-46

The month-end status of extrusion Production Tests worked on during the month is as follows:

<u>Production Test No.</u>	<u>Subject</u>	<u>Status</u>
314-24-M	UM Material - High Sn, Etc.	Complete except for laboratory analyses and extrusion of last four billets.
314-25-M	Optimum Canning Temperatures	To be investigated further after improved rod handling facilities have been brought to consistent use.
314-26-M	Product Yield and Scrap Data	Completed.
314-32-M	Cast Dogs - August Shipment	Part II - Work covering last two lots is in progress.
314-33-M	Reduced Diameter Rods	Completed
314-34-M	Machining Scrap Study	In Work
314-35-M	BT Material Study	Completed; however, certain calculations are being investigated further.

Canning

Selected Canned Material - Production Test 313-75-M

Investigations into the causes of dimensional distortion of canned material given long exposure in the piles have led to the conclusion that some characteristic of the slug metal is chiefly responsible. It was thought that a probable cause for such distortion might be in the physical unsmoothness of the base metal. In order to gain information in this respect, it has been agreed that a number of pieces should be canned in which the slug metal was as nearly perfect as could be determined by any known tests applicable in the 300 Area. These "super" slugs are to be loaded in a pile and exposed over a prolonged period, following which they are to be examined for evidence of distortion. If the best obtainable material cannot withstand such exposure, it will indicate that high concentration of product may not be feasible. If, on the other hand, this carefully selected material more successfully withstands protracted exposure in the pile, it will indicate that closer controls than those currently employed will be required on slugs intended for high-concentration exposure.

Approximately 100 of these carefully selected slugs have already been prepared from cast material, and present schedules call for the preparation of about 400 more made from extruded material during the first week in February.

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8-11-48

Relationship of Porosity to Slug Weight

In attempts to correlate varying slug weight or apparent density with the amount of porosity, the following relationships were investigated:

- 1) Correlation of density with degree of porosity.
- 2) Correlation of surface condition with degree of porosity.
- 3) Correlation of electrical methods of detection with degree of porosity.

The results of investigations along these lines conducted to date lead to the following conclusions:

- a) The coefficient of correlation between density and porosity is statistically insignificant.
- b) On the basis of data obtained in the present study, it appears that the weight of raw slugs cannot be taken as a criterion for classifying them according to their degree of porosity.
- c) Rejection of all pieces showing, after pickle, external evidence of internal discontinuities would result in the scrapping of about 14% of production. This is too high to be economically feasible, for present maximum levels of exposure. If use of porous slugs is to be avoided, the only alternative is to improve methods and techniques of extrusion.

Thorium

A shipment of approximately 200 pounds of thorium was received recently. This material is in extruded form and consists of 4 rods from 4 to 8 feet long which are to be cut into 4-inch slug lengths. The rods are very crooked and require straightening of some sort before they can be machined into slugs. Since a principal requirement is that these slugs shall not be contaminated with uranium, it will be necessary to straighten the rods on an improvised straightening press, and machine the slugs on a special lathe which has never been used for cutting uranium. Following machining into slugs 4 inches long and 1.388 ± 0.003 inches in diameter, this material is to be canned according to standard process used for bismuth slugs.

Al-Si Bath Composition Change During Use

Attempts to keep the Si content of casting baths within specifications by balancing drag-out loss with as-received Al-Si have proven fruitless. Even boiling the bath sufficiently to allow a 50-lb. addition of high Si melt (as-received Al-Si runs about 12.5% Si, the casting bath specifications are 11.5-11.7% Si) during a shift failed to keep the Si within specifications in two out of three series of checks made. The only apparent practicable method of keeping up the Si concentration is to use an enriched melt to balance drag-out. The enriched melt can be prepared by using master alloy ingots of about 20% Si and of such size that a single melt of as-received ingots will maintain a Si content of about 12.5% in the melt. It is believed that additions of this melt to balance casting pot drag-out (amounting normally to around 20 pounds/shift) will be just sufficient to keep the Si concentration of the casting bath at or slightly above the minimum specification. A number of master alloy ingots have been prepared for the above purpose but several minor points remain to be investigated before a production test is made.

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General Metallographic Studies

Investigations preliminary to a production test of the use of enriched melts to balance canning pot drag-out and of the effects of high and low Si content in the canning bath on canning symptoms have revealed the possible presence of major uncontrolled variables. Since these could readily invalidate results, the tests are being delayed until a broader basis of facts is obtained. In addition to the above, several determinations are being made to facilitate interpretation of results. Included are:

- 1) Solution rate vs composition and temperature above initial freezing point. (Al-in Al-Si)
- 2) Time to remelt solidified metal on samples vs temperature above initial freezing point.
- 3) Wetting characteristics vs temperature above initial freezing point.
- 4) Accuracy of thermal analysis of hyper-eutectic Al-Si alloys.
- 5) Effect of small amounts of tin in Al-Si on solution rate and wetting of Al.
- 6) Effect of minor impurities in Al on its solution rate, etc.
- 7) Means of producing crack-free ingots of high Si master alloys.
- 8) Effect of pre-heat temperatures on wetting characteristics of samples.
- 9) Rate of loss of Si from high Si melts standing in air.
- 10) Rate of re-resolution of pre-eutectic Si crystallites when cast master alloy ingots are added to melt.

The present status of these studies is as follows:

- Item 1) Curves obtained to date (solution rate on ordinate) show less slope for alloys approaching eutectic composition than for lower Si alloys.
- Item 4) Cooling curves have less marked change in slope at liquidus than do hypo-eutectic alloys. Analyses made to date indicate an expected error of about $\pm 0.5\%$. This is considered adequate for the purposes for which high Si alloys are to be used.
- Item 6) Effect of Mg is negligible below 0.5% , which is well over the tolerance.
- Item 9) Losses are slight for the time periods that will probably be involved - less than the expected error in thermal analysis of such alloys.
- Item 10) The rate is apparently adequate to prevent trouble from agglomerated crystallites being carried into and remaining in the canning bath.

Preliminary investigations are also being made in an attempt to obtain a rapid means of determining non-random or unsymmetrical lattice orientation on slug surfaces. Therefore, hardness anisotropy as exhibited by micro indentations normal to various planes, and anisotropy with regard to thermoelectric effects have been investigated briefly, but results are not promising. The main difficulty is determination of orientation in the first place in order to make the tests.

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