

O T T A W A February 16th, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1165.

Investigation of "Meta" Aluminium Solder.

(Copy No. 5.)

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
—
ORE DRESSING AND
METALLURGICAL LABORATORIES



CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Origin of Material and Object of Examination:

We recently received, under R.C.A.F. file No. 902-38-1, a number of samples of aluminium soldering on different gauges of metal and also a piece of the solder. This material was supplied by the Johnson Brazing and Alloy Company Limited, 17 Stephanie Street, Toronto, Ontario. It was requested that the solder and the soldered joints be investigated.

Physical Testing:

The following tensile test specimens were prepared:

- No. 1. - 0.252" x 0.116" - Aluminium strip.
- No. 2. - 1.00" x 0.112" - Aluminium strip containing soldered joint.
- No. 3. - 0.251" x 0.120" - Aluminium strip.
- No. 4. - 1.00" x 0.126" - Aluminium strip containing soldered joint.
- No. 5. - 1.00" x 0.081" - Dural strip containing soldered joint.

These test pieces are shown (from left to right) in Figure 1. The results of the tensile tests are shown in Table I.

Table I.

Tensile Tests on Soldered Aluminium.						
Test No.	Material	Size	Breaking Load, pounds	Ultimate strength, p.s.i.	Elong., % in 2"	Remarks
1	Aluminium	0.252" x 0.116"	480	16,500	12.0	
2	Aluminium soldered	1.00" x 0.112"	1,800	16,200	11.0	(Broke in parent metal.)
3	Aluminium	0.251" x 0.120"	500	16,700	9.0	
4	Aluminium soldered	1.00" x 0.126"	2,100	16,700	10.0	(Broke in parent metal.)
5	Dural soldered	1.00" x 0.081"	2,300	28,400	1.0	(Broke in soldered joint.)

Figure 2 shows some of the tests applied to the soldered pieces. The soldered joint has apparently absorbed considerable punishment without failing. Such treatment would not normally be inflicted upon this material in service except in an emergency or accident.

Chemical Analysis:

	<u>Per cent</u>
Tin	- 98.10
Zinc	- 0.81
Cadmium	- 0.26
Silver	- 0.41
Copper	- 0.50

Microscopic Examination:

Cross-sections of the soldered joints were prepared for microscopic examination. Two photomicrographs are submitted, in Figures 3 and 4, taken at 100 diameters.

Figure 3 shows that this solder must be very fluid since it can apparently flow into very small crevices. Both Figures 3 and 4 show that the solder fuses perfectly with the parent aluminium.

Discussion of Results:

It would appear to be possible to make a joint between two pieces of commercially pure aluminium with this solder that is mechanically stronger than the parent metal. However, there is some doubt where duraluminium is concerned. It will be noted that the actual load on the soldered joint was greater in Test No. 5 than in Test No. 4. This would appear to indicate that it might not be possible to develop the full mechanical properties of duraluminium or any of the other strong aluminium alloys, in a joint made by this method.

From an examination of Figure 2, such a joint, made in commercially pure aluminium, is apparently tough.

The microscopic examination indicates that the solder possesses high fluidity and forms a perfect union with commercially pure aluminium.

Conclusions:

"Meta" aluminium solder would appear to be a satisfactory method of joining two pieces of commercially pure aluminium.

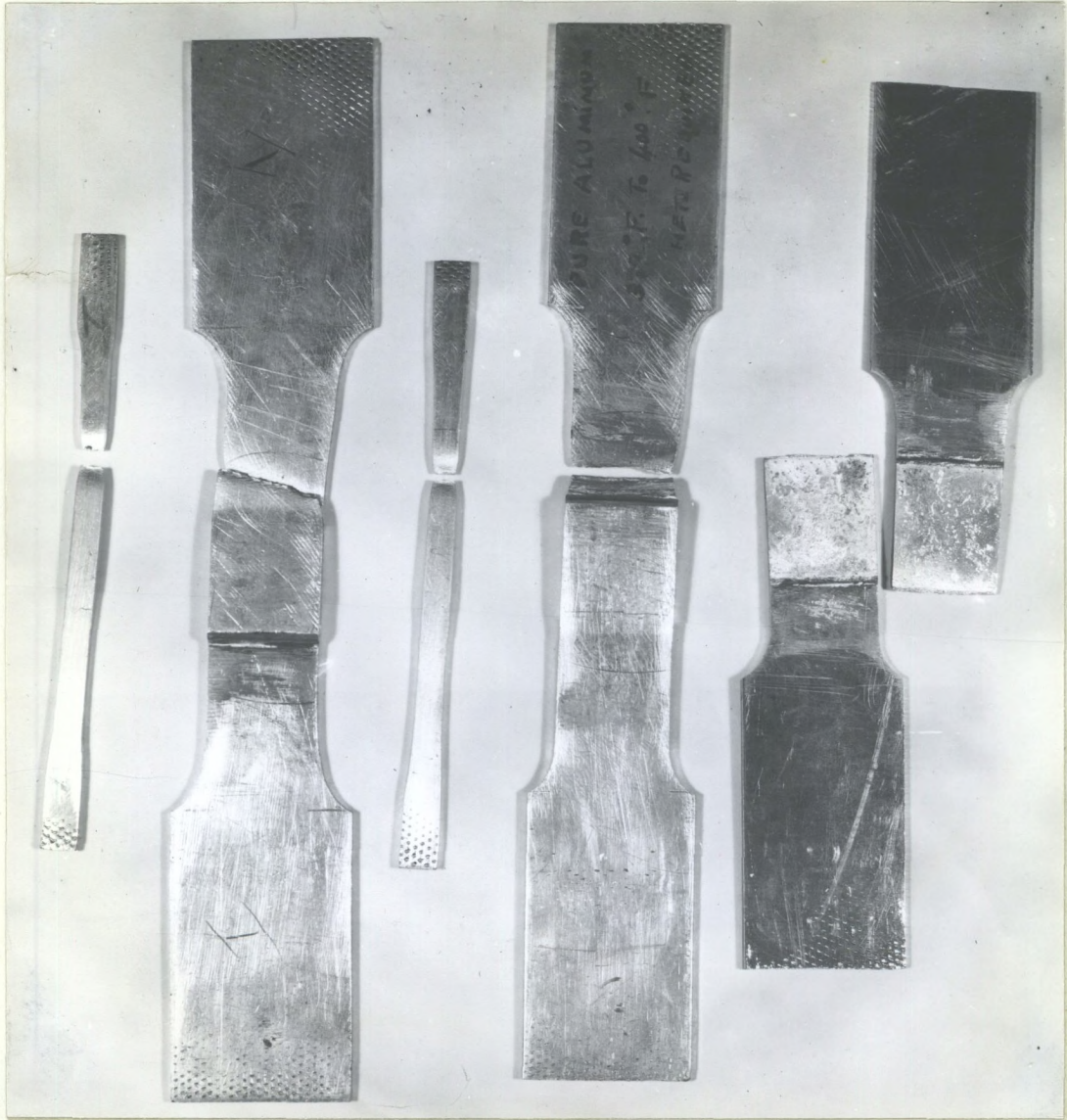
Recommendations:

Should the use of "Meta" aluminium solder ever be contemplated for making joints in strong aluminium alloys, where high mechanical efficiency is required, it would be advisable to examine this type of application very thoroughly prior to its adoption.

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HVK:GHS.

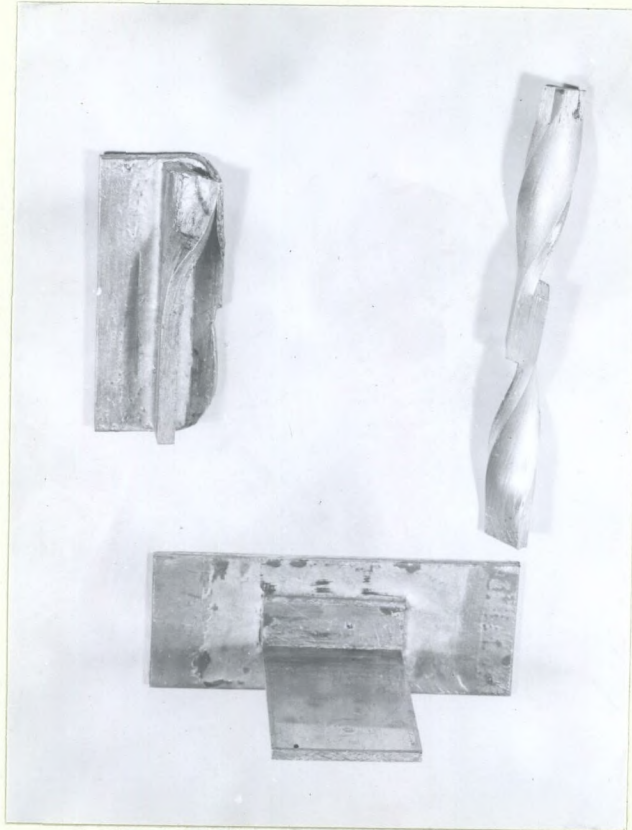
Figure 1.



TENSILE TEST PIECES USED IN INVESTIGATION.

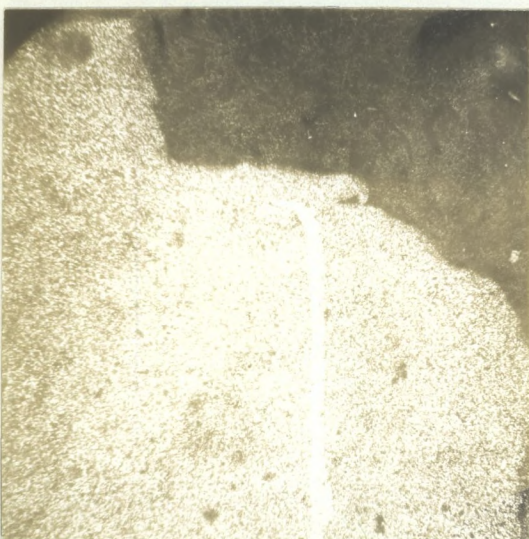
(Approximately $\frac{3}{4}$ size).

Figure 2.



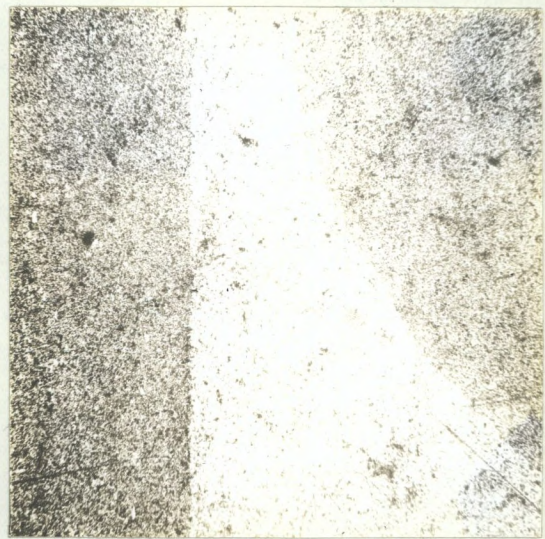
SAMPLES OF ALUMINIUM SOLDERING.
(Approximately $\frac{3}{4}$ size).

Figure 3.



X100, unetched.

Figure 4.



X100, unetched.

SOLDERED JOINTS.