

DEC 22 1969

NATIONAL BUREAU OF STANDARDS REPORT

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Progress Report on the
**STRESS-CORROSION BEHAVIOR OF DIE
FORGED ALUMINUM ALLOY 7175-T736**

To
Materials Division
Naval Air Systems Command
Department of the Navy



U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NATIONAL BUREAU OF STANDARDS

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By
W. F. Gerhold
Engineering Metallurgy Section

To
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Progress Report on the
Stress-Corrosion Behavior of Die
Forged Aluminum Alloy 7175-T736

By

W. F. Gerhold
Engineering Metallurgy Section

Reference: (a) Naval Air Systems Command letter,
AIR-52031A: RS/53 dated August 16, 1968

Introduction: A new Alcoa die forged aluminum alloy designated 7175 has been reported to have good stress-corrosion cracking resistance when heat treated to the -T736 condition. Reference (a) requested that NBS conduct tests to determine the stress corrosion behavior of this alloy in artificial laboratory and marine environments. This report contains the results obtained from tests conducted in the artificial laboratory environments only.

Material: A die forged 7175-T736 aluminum alloy section (Die No. 9112) approximately 36 in. long was submitted for test by the vendor. Specimens in the form of flat tensile bars were machined from this section so that their principal axes were in the transverse direction with respect to the direction of working of the forging. The specimens were approximately 3 in. long by 0.75 in. wide by 0.125 in. thick.

Tensile Properties: The results of tests conducted by NBS to determine the tensile properties of the die forged 7175-T736 aluminum alloy are given in Table 1.

Table 1. Transverse tensile properties^(a) of die forged 7175-T736 aluminum alloy

Tensile Strength, ksi	76.5
Yield Strength (0.2% offset), ksi	68.3
Elongation in 1 inch, percent	11.0

(a) Average of three specimens.

Stress-Corrosion Tests: Stress-corrosion tests were conducted in artificial laboratory environments. A system of weights and levers was used to obtain the desired stress.

The specimens were encased in polyethylene cells which were used to contain the corroding media. The specimens were immersed intermittently in the corrodent, once in every 45 minutes, by pumping the corrodent into the cell and then allowing it to drain back into a reservoir. Two corroding solutions were used; one a 1N sodium chloride solution containing 10 ml of hydrogen peroxide (30%) per liter of solution and the other a straight 3.5% sodium chloride solution. Specimens were exposed in both environments at stresses equivalent to 75% of the yield strength of the alloy as determined by NBS. The percent loss in tensile strength was determined for each specimen to give an indication of the extent of corrosion. These determinations, shown in Table 2, revealed that the corrosion rate of the stressed specimens exposed in the more aggressive NaCl-H₂O₂ solution was higher than that for stressed specimens exposed in the 3.5% NaCl solution. The corrosion rates were similar for unstressed specimens exposed in both environments.

Conclusions: The results obtained from stress-corrosion tests conducted in artificial laboratory environments on die forged 7175-T36 aluminum alloy indicate that the alloy has good resistance to stress-corrosion cracking.

There were no stress-corrosion failures after approximately 61 days exposure in either the NaCl-H₂O₂ or 3.5% NaCl environments.

The corrosion rate, for specimens stressed at 75% of the yield strength of the alloy, was higher in the NaCl-H₂O₂ environment than in the 3.5% NaCl environment. The corrosion rate for unstressed specimens was similar in both environments.

Table 2. Results obtained from stress-corrosion tests conducted in artificial laboratory environments.

Environment	Exposure Stress, % of Yield Strength	Exposure Stress, ksi	Days Exposed ^(a)	Percent Loss in Tensile Strength
3.5% NaCl	75	51.4	61 NF	17
	75	50.9	62 NF	6
	75	50.9	61 NF	12
			Avg.	12
	0	-	62 NF	5
	0	-	62 NF	7
	0	-	62 NF	6
			Avg.	6
NaCl-H ₂ O ₂	75	51.4	61 NF	19
	75	50.9	61 NF	7
	75	50.9	61 NF	22
			Avg.	16
	0	-	61 NF	5
	0	-	61 NF	7
	0	-	61 NF	3
			Avg.	5

(a) NF indicates no failure after exposure for the number of days shown.



