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STRESS CORROSION BEHAVIOR OF X7050-T76351 ALLOY ALUMINUM PLATE

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Reference: (a) Naval Air Systems Command, Department of the Navy, Request by AIR-52031, January 20, 1972.

Introduction

It was requested by Reference(a) that NBS conduct tests to determine the stress-corrosion behavior of X7050-T76351 aluminum alloy plate in a marine atmosphere environment.

Material

A section of X7050-T76351 aluminum alloy plate [12 in. (30.5 cm) x 2 in. (5.1 cm) x 4-1/2 in. (11.4 cm)] was obtained from the Naval Air Development Center, Warminster, Pa. Specimens in the form of flat tensile bars were machined from this plate so that the principal axes of the specimens were in the transverse direction with respect to the direction of rolling of the plate. The tensile specimens were approximately 9 in. (22.86 cm) long by 1 in. (2.54 cm) wide by 0.125 in. (.32 cm) thick.

Mechanical Properties

Tests were performed by NBS to determine the transverse mechanical properties of X7050-T76351 alloy plate. The results of these tests are shown in Table 1.

Stress-Corrosion Tests

Stressed and unstressed specimens were exposed in the marine atmosphere at Kure Beach, N.C. [80-foot (24 m) lot]. A system of weights and levers was used to obtain the desired stress. For the stressed specimens, the applied

stress was equivalent to 50 and 75% of the yield strength of the alloy as determined by NBS.

Results

Test results show that none of the X7050-T73651 alloy specimens had failed after exposure in the marine atmosphere for a period of 756 days. In order to obtain some indication of the effect of corrosion attack on the alloy, a comparison was made of the tensile strength of specimens not exposed to the corrosive environment vs. that of specimens exposed to the marine environment. The values obtained were then averaged for each condition and stress level and calculated as the percent loss in tensile strength due to exposure in the environment. These test results, given in Table 2, indicate a small average loss (less than 10%) in tensile strength for the exposed specimens.

Conclusions

The results obtained from stress corrosion tests on X7050-T73651 aluminum alloy plate indicate that the alloy is resistant to stress corrosion cracking in a marine atmosphere environment. There were no failures after exposure for 756 days. However, the alloy does exhibit a considerable amount of shallow surface pitting, accompanied by heavy adherent light gray corrosion products. This surface pitting and corrosion resulted in an average loss in strength of less than 10 percent.

Table 1

Transverse Mechanical Properties of X7050-T73651 Aluminum Alloy Plate[a]

Tensile Strength Ksi[b]	Yield Strength (0.2% offset) Ksi[b]	Percent Elongation in 2 in.
75.9 ± 2.1	67.2 ± 1.5	8.2 ± 1.4

[a] Average of three specimens with standard deviations.

[b] 1 Ksi = 6.8948 MPa

Table 2. Results Obtained from Tests on X7050-T73651 Aluminum Alloy Plate in the Marine Atmosphere at Kure Beach, North Carolina (80-foot lot).

Exposure Stress: Percent of Yield Strength	KSI	Days Exposed (1)	Percent loss in Tensile Strength	Percent Loss in Tensile Strength (3)	Percent Elongation in 2 in. (5.08 cm)
0	-	756 NF	<1		6%
0	-	756 NF	8		(2)
0	-	756 NF	8	6	4%
50	33.8	756 NF	<1		
50	33.6	756 NF	18		6%
50	33.5	756 NF	3	7	
75	50.3	756 NF	<1		(2)
75	50.1	756 NF	5		6%
75	50.8	756 NF	<1	1	8%

(1) NF denotes no failures after exposure for number of days indicated.

(2) Specimen broke outside gage marks.

(3) Average for three specimens

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16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Short transverse tensile specimens of X7050-T76351 aluminum alloy were stressed at fifty and seventy-five percent of the alloy's yield strength and exposed in a marine atmosphere environment. After seven hundred and fifty-six days, there were no failures. X7050-T76351 alloy appears to be resistant to stress corrosion cracking in this environment.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Alloy; Aluminum; Atmosphere; Marine; Mechanical properties; Plate; Stress corrosion

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