NBSIR 78-1464 (R)

Stress Corrosion Behavior of Clad 7050-T76 Aluminum Sheet

B. T. Sanderson and W. F. Gerhold

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Stress Corrosion Tests

Stressed and unstressed specimens of both thicknesses 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 on the stress corrosion specimens. The specimens were exposed with an applied stress approximately equivalent to 0, 50, and 75% of the yield strength of the alloy as determined by NBS [67.4 Ksi (465 MPa)] for the 0.088 in. (2.24 mm) thick specimens, and [65.8 Ksi (454 MPa)] for the 0.123 in. (3.12 mm) thick specimens.

Results

None of the stress corrosion specimens had failed after 798 days exposure in the marine atmosphere. Visual examination of the specimens after exposure in the marine atmosphere revealed the presence of heavy, adherent gray corrosion products with considerable localized pitting corrosion. Companion unstressed specimens which had been exposed for the same period of time were removed from exposure along with the stressed samples. In order to obtain an indication of the effect of corrosion attack on the material, a comparison was made of the tensile properties of unexposed specimens vs. those of specimens exposed to the marine environment. The values were then averaged and calculated as percent loss in tensile strength due to exposure in the environments. The results given in Table II revealed no significant loss in tensile strength as a result of exposure.

Metallography

Transverse sections were obtained from the exposed samples for metallographic examination (Fig. 1). The localized corrosion pitting is visible in the cladding material. In general, the microstructure revealed a uniform grain size in both the clad and core material.

Conclusions

The results obtained from stress-corrosion tests on clad 7050-T6 aluminum alloy sheet material indicate that the alloy is not susceptible to stress corrosion cracking in a marine atmosphere environment. No failures were observed on specimens stressed at approximately 50 and 75% of the alloy's yield strength after exposure for 798 days. This is in agreement with earlier tests conducted on X7050-T76351 aluminum alloy plate. However, as with the X7050-T76531 alloy, the clad 7050-T76 alloy was susceptible to shallow surface pitting corrosion. This corrosion did not appear to affect the tensile properties of the clad 7050-T76 alloy where the loss in tensile strength due to corrosion was negligible (less than 2% of the original tensile strength on unstressed specimens) as compared to that of the unclad X7050-T76351 alloy (approximately 8%). The clad layer on the sheet material provided protection from corrosion to the core material.

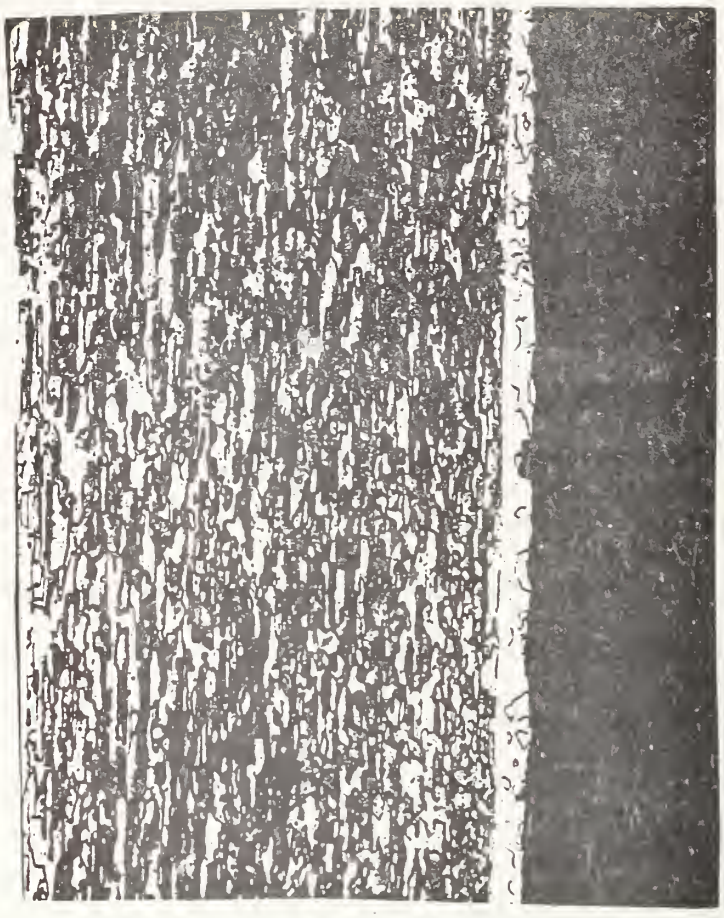

Figure 1. Photomicrograph of clad 7050-T76 aluminum alloy showing localized pitting corrosion in the cladding material and typical microstructure. Etched, Kellers Etch. X50.

TABLE I

Transverse Mechanical Properties of Clad 7050-T76
Aluminum Alloy Sheet

Sheet Thickness	Tensile Strength (1) Ksi (2)	Yield Strength (1) (0.2% offset)	Percent Elongation in 2 in. (5.08cm) (1)
0.088 in (2.24 mm)	76.2 ± 0.4	67.4 ± 0.6	11 ± 1.0
0.123 in (3.12 mm)	74.8 ± 0.5	65.8 ± 0.1	12 ± 0.3

(1) Average for 3 specimens with standard deviations.

(2) 1 Ksi = 6.8948 MPa.

TABLE II

Results Obtained from Tests on Transverse Specimens of Clad 7050-T76 Aluminum Alloy Sheet after Exposure in a Marine Atmosphere at Kure Beach, N.C. [80-foot (24m) lot]

Sheet Thickness	Exposure Stress Percent of Yield Strength	Ksi (1)	Days Exposed (2)	Percent Loss in Tensile Strength	
0.088 in (2.24 mm)	0		798NF	1.2	
	0		798NF	1.6	
	0		798NF	0.1	1.0 Ave.
	50	34.2	798NF	0.2	
	50	34.0	798NF	1.6	
	50	34.2	798NF	1.7	1.2 Ave.
	75	51.2	798NF	1.4	
	75	51.0	798NF	0.2	
	75	50.6	798NF	0.5	0.7 Ave.
0.123 in (3.12 mm)	0		798NF	0	
	0		798NF	1.6	
	0		798NF	0.1	0.6 Ave.
	50	32.5	798NF	0.5	
	50	32.5	798NF	0.4	
	50	32.5	798NF	0.4	0.4 Ave.
	75	49.2	798NF	0.8	
	75	49.6	798NF	1.5	
	75	49.6	798NF	0.5	0.9 Ave.

(1) 1 Ksi = 6.8948 MPa.
(2) NF denotes no failure after exposure for number of days shown.

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15. SUPPLEMENTARY NOTES

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.)*

Transverse tensile specimens of clad 7050-T76 Aluminum alloy were stressed at zero, fifty, and seventyfive percent of the alloy's yield strength and exposed in a marine environment. After 798 days exposure, there were no failures. The clad 7050-T76 material studied 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; cladding; marine; mechanical properties; sheet; stress corrosion

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