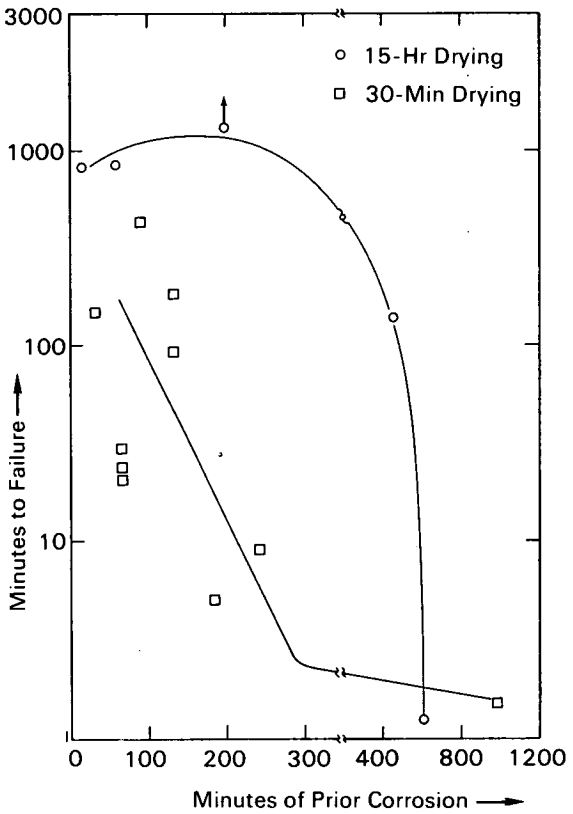
September 1970

Brief 70-10396

NASA TECH BRIEF

Increased Resistance to Stress Corrosion of Aluminum Alloys



Time to Failure Versus Time of Prior Corrosion for Specimens Dried After Prior Corrosion

A method of increasing the stress corrosion resistance of high strength aluminum alloys has been developed. The method is based on two observations:

First, surface treatment such as machining or shot peening distorts the surface grain-boundary structure. Since stress corrosion of such alloys (specifically aluminum-7075) occurs along grain boundaries, it cannot begin before the distorted surface layer is penetrated by pure corrosion.

Second, both pure corrosion and stress corrosion start initially at particular sites, beginning with the most favorable ones. If the corrosion and stress corrosion are interrupted, as by removal of the corrosive environment, and the aluminum is later reexposed, the corrosion and stress corrosion are not reinitiated at the earlier sites but at completely new ones. These new sites are less favorable than the original sites, so that corrosion and stress corrosion now proceed at rates lower than their original rates; thus final failure of the aluminum occurs later than if the corrosion had not been interrupted.

Unstressed specimens of aluminum-7075-T651 were corroded for various times in a 1*M* solution of NaCl buffered to pH 4.7 with sodium acetate and acetic acid; the density of the anodic current applied was 0.3 mA/cm^2. After corrosion the specimens were removed and dried in a partial vacuum for either 30 min or 14 hr. When the 30-min specimens were reexposed to corrosion under stress, the time to failure was shorter than if the corrosion had not been interrupted. When, however, the drying was very thorough (14 hr) the time to failure was greatly increased (see fig.). Thus the anodic treatment increased the aluminum's resistance to stress corrosion.

Notes:

1. The aircraft, chemical, and boatbuilding industries, metallurgists, oceanographers, and designers of high-strength aluminum structures may be interested.

(continued overleaf)

2. Requests for further information may be directed to:

Technology Utilization Officer
Code A&TS-TU
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: TSP70-10396

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: S.B. Brummer and F.H. Cocks of
Tyco Laboratories, Inc.
under contract to
Marshall Space Flight Center
(MFS-20788)