Materials Engineering Branch

TIP*

No. 013 Stress Corrosion Cracking of Aluminum Alloys

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Aluminum alloys are commonly used on spacecraft in structural applications for a variety of reasons including lightweight, non-magnetic, and ease of fabrication. It is typical for designers to select those alloys which can be heat treated to provide the highest strengths, e.g., 2014-T6, 2024-T3 and T4, 7075-T6 and 7178-T6.

However, these alloys in the heat-treated conditions listed are susceptible to stress corrosion cracking (SCC) even in non-coastal industrial atmospheres. Although the yield strengths of these heat-treated alloys may range from 47,000 to 68,000 psi, they can develop SCC at sustained tensile stress levels as low as 7,000 psi within as short a time as 100 days. The time period is even shorter in a coastal atmosphere.

All of those alloys can be given alternate heat treatments to make them less susceptible, or even immune, to SCC but with some loss in strength. The problem of SCC becomes more acute when the alloy stock is thicker than 1/2 inch.

If complex shapes are machined from heat treated heavy section plates or extrusions, the residual stresses become re-distributed and may result in near yield-point values even with no service loads and SCC can occur readily. Anodize and chromate conversion coatings do not inhibit SCC significantly. Shot or glass-bead peening and plastic or paint films help to delay the SCC.

All designers should be aware of the problem and should investigate it before selection of any of the aforementioned alloys and heat-treated conditions. To avoid problems with these and other alloys that are susceptible to SCC, the reader is referred to NASA 6004, entitled, "Design Criteria for Controlling Stress Corrosion Cracking," Stress corrosion data is also available in MSFC-HDBK-527 (latest revision) and in MSFC's data base, MAPTIS.

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