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Brief 66-10595

NASA TECH BRIEF

Treatment Increases Stress-Corrosion Resistance of Aluminum Alloys

The problem:

The direct parametric relationship between yield strength and stress-corrosion resistance of the precipitation-hardened aluminum alloys (2000, 6000, and 7000 series) is an important consideration in the design of highly stressed structural members. Design compromises that must be made to compensate for either of these parameters result in a higher weight, a reduction in safety factor, or a shorter life of the member.

The solution:

Near optimum values of both yield strength and resistance to stress corrosion are achieved by overaging during heat treatment of the aluminum alloys, immediately followed by moderate plastic deformation, preferably by shock loading.

How it's done:

Heat treatment of the alloys is first carried out in accordance with the producer's normal specifications at the recommended temperatures. For example aluminum alloy 7075 is solution annealed at 870° to 890°F for 10 minutes to 1 hour, rapidly cooled to a temperature between 240° and 260°F, and aged from 23 to 28 hours at this temperature. This treatment converts the alloys to the T6 condition, which provides maximum yield strength but very poor stress-corrosion resistance. Although overaging of the T6 alloy to the T73 condition (by a proprietary process) improves its stress-corrosion resistance, this gain is counteracted by a 14 percent decrease in yield strength. By explosively shock loading the alloy immediately following the conversion to the T73 condition, 80 percent of the yield strength loss is recovered without degrading the resistance of the T73 alloy to stress corrosion. The shock loading level must be sufficient to produce moderate plastic deformation without significantly changing the dimensions of the alloy.

Notes:

1. It is believed that similar results can be obtained by substituting a conventional deformation process (e.g., rolling, forging, or extruding) for the shock loading step.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B66-10595

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: A. J. Jacobs
of North American Aviation, Inc.
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Category 05