September 1970

Brief 70-10506

NASA TECH BRIEF

Effects of Crystal Defects on Stress-Corrosion Susceptibility in Aluminum Alloy 7075

Research has been conducted to determine the effects of crystal-lattice point defects on the susceptibility of aluminum alloy 7075 to stress-corrosion cracking. Defects were introduced into specimens of the alloy by neutron irradiation, and the growth of stress-corrosion cracks was observed. Three separate stages of the cracking process were defined: pre-growth, from irradiation to crack initiation; slow growth; and catastrophic growth, ending in specimen failure. It was discovered that the duration of the pre-growth phase is closely related to t_f, the total time from irradiation to failure, but that the duration of the slow growth phase is less closely related to t_f.

Point defects were introduced into specimens of three heat-treated tempers of alloy 7075 (-T6,-T73, and a temper intermediate to these) by irradiation with fast neutrons to a fluence of 8×10^{18} nvt. Continuous ultrasonic monitoring of the irradiated specimens, silmultaneously using back-reflection and pulse-echo techniques, allowed the growth of the cracks to be observed. Of the three tempers, only -T6, the least aged, showed a significant increase in stress-corrosion susceptibility. Concurrently, the maximum elongation exhibited by the -T6 specimens was reduced by one-third. Other mechanical properties, such as yield strength and hardness, showed no significant change. In cryogenic tensile tests above 100°K, the yield strengths of both irradiated and control samples of alloy 7075-T6 were much less temperature dependent than were those of samples of the other two tempers. Also the -T6 was the only temper of the three to exhibit negative strain-rate effects in strain-rate sensitivity tests.

Notes:

1. Information on related research involving stress corrosion in aluminum alloy 7075 may be found in NASA Tech Briefs B67-10533, Study of Stress Corrosion in Aluminum Alloys, B68-10153, Study of Crack Initiation Phenomena Associated with Stress Corrosion of Aluminum Alloys, and B70-10527, Mechanism of Stress Corrosion Cracking in in Aluminum Alloy 7075.
2. Requests for further information may be directed to:

   Technology Utilization Officer
   Code A&TS-TU
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: TSP-10506

Patent status:

No patent action is contemplated by NASA.

Source: A. J. Jacobs and G. G. Bentle of
North American Rockwell Corp.
under contract to
Marshall Space Flight Center
(MFS-18794)

Category 04