

# Effects Of Surface Treatment on the Corrosion and the Fatigue Behavior of a High Strength Aluminum Alloy.

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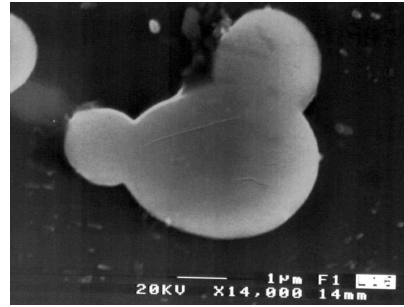
2024-T351 is an aluminum alloy widely used in the aircraft industry due to its high strength. The alloying element copper improves the mechanical properties of the alloy, but tends to decrease its corrosion resistance. Therefore, a surface treatment is required to protect its surface against corrosion. In Europe, environmentally friendly surface treatments such as alkali borax anodizing are being evaluated as alternatives to chromate conversion coating [1]. In order to reach the performances of the chromate coatings, a good pre-treatment is required to modify the alloy surface. A typical treatment involves etching in sodium hydroxide, in order to remove the deformed layer on the surface, and desmutting in nitric acid to remove the oxides left on the surface and decrease the amount of copper accumulated on the surface after etching. An addition of  $\text{CeCl}_3$  in the desmut solution improves the corrosion behavior of the alloy.

There are two main types of intermetallic particles that are more than  $1 \mu\text{m}$  in size. One of them predominantly affects the corrosion behavior of the alloy, the S-phase, and the other dominates the fatigue life. Those particles are uniformly distributed along the rolling direction, but through the thickness of the plate, it was found that there were more particles close to the surface than in the middle of the plate. This paper concentrates on the effect of the particles distribution on the corrosion behavior of the alloy and on the effects of both cerium and chloride ions added to the desmut bath on the S-phase. The addition of  $\text{CeCl}_3$  or  $\text{NaCl}$  in the desmut bath dissolves the S-phase particles, improving the corrosion behaviour of the alloy.

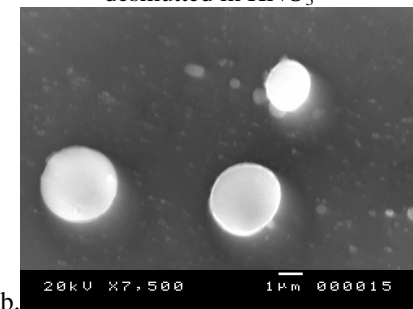
This study was carried out using electrochemical tests and detection of corrosion with Agar gel (2)

## References:

1. A. Pakes, G. E. Thompson, P. Skeldon, and K. Shimizu, *Trans IMF*, **77**, 171-177 (1999).
2. H. S. Isaacs, G. Adzic, and C. S. Jeffcoate, *Corrosion*, **56**, 971-978 (2000)

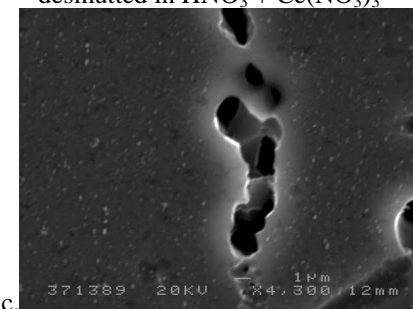


S-Phase particles on surfaces etched in NaOH then desmutted in  $\text{HNO}_3$



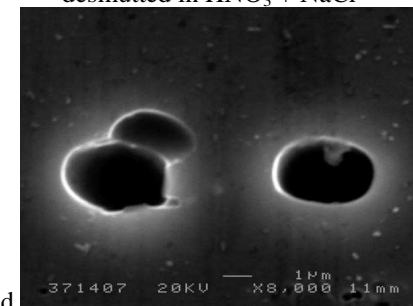
b.

S-Phase particles on surfaces etched in NaOH then desmutted in  $\text{HNO}_3 + \text{Ce}(\text{NO}_3)_3$



c.

S-Phase particles on surfaces etched in NaOH then desmutted in  $\text{HNO}_3 + \text{NaCl}$



d.

S-Phase particles on surfaces etched in NaOH then desmutted in  $\text{HNO}_3 + \text{CeCl}_3$