Al and Al Alloy-Ti Series Surface Passivation Technology

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Introduction

Aluminum is a chemically active metal and can naturally form colorless and transparent oxidized film on its surface to protect the substrate of the aluminum material, however, the protecting function of the oxidized film is limited. Moisture, sour gas, salt, etc. in the atmosphere could accelerate corrosion, and thus, different kinds of passivating techniques have been developed long time ago. Generally, there are electrochemical method and chemical method.

Conventional chemical passivation for Aluminum and Al-alloy often uses chromate as simple process techniques with good self-repairing function when there is rust on the surface transforming film, indicating the good corrosion resistance, and hence, it has been using for a long time. But, Cr (VI) as heavy metal displayed great health impacts through environmental pollution. With the increase in environmental protection, it has been gradually forbidden and limited to use all over the world. EU changed the ROHS regulation and claimed that from July 1, 2006 on, all the electrical and electronic products should not contain six kinds of harmful matters, Cr is one of those, therefore, to develop Al alloy transforming film to replace chromate will be a future trend.

With continuous efforts on research and development, non-Cr passivating technique for replacing chromate transforming film can provide different types of transformation methods presently, eg., tatinium fluoride, zirconium fluoride, molybdate, and phosphate, etc., transforming films.

Product:

This company cooperated with Janpanese techniques and developed a kind of non-Cr aluminum alloy chemical transforming film mainly as Ti salt, labled as Ching-Feng NO.957.

Procedure:

Degrease → water wash → deoxidized film → water wash → NO.957 film formation →water wash

Parameters:

NO.957 working concentration 2~5%

Treatment temperature 15~40°C

Treating time 1~4 min

Al and Al alloy produce light blue color oxidized film after NO.957 passivating treatment.

Reaction:

$2Al + 4H_2O \rightarrow 2AlO(OH) + 3H_2 \rightarrow Al_2O_3 + H_2O$

$2Al + 6H^+ + 3TiF_6 + 5H_2O \rightarrow 2\ AlOF\cdot 3TiOF_2 + 10HF + 3H_2\uparrow$

Main components in the surface oxidized film include Al_2O_3 and $2AlOF\cdot 3TiOF_2$

Oxidized film corrosion resistance:

(1) salt spray test

A. the Al samples after NO.957 passivating treatment, put in the salt spray testing chamber, spray continuously for 48 hr, no spot corrosion occurs on the surface.

B. traditional Cr (VI) passivating treated Al samples, put in the salt spray test chamber, spray continuously for 200hr, no spot corrosion on the surface.

C. non-passivating treated Al samples, put in the salt spray chamber, spray continuously for 24hr, serious spot corrosion occurs on the surface.

(2) film salt spray test

A. NO.957 passivating treated Al samples, after powder spray coating, put in the salt spray test chamber, spray continuously for 800hr, no bubbles, peeling off, and oxidation appear on the film.

B. traditional Cr(VI) passivating treated Al samples, after powder spray coating, put in the salt spray test chamber, spray continuously for 800hr, no bubbles, peeling off, and oxidation appear on the film.

Conclusion

NO. 957 passivating treated Al and Al alloy, comparing to the Cr passivating treated

film, pre-coating surface displayed slightly lower corrosion resistance due to the transforming film's thinner thickness. However, transforming film and coating layer showed good adhesion strength, the same as the corrosion resistance of traditional Cr (VI) treated transforming film.

Ching-Feng NO.957 passivating agent, has advantages of simple operation procedures, easy to handle, long life time of passivating solution, low environmental pollution and can be a good choice of replacing Al and Al alloy Cr series transforming film.