# NASA TECH BRIEF



## Corrosion Protection of Aluminum Alloys in Contact with Other Metals

Aluminum alloys used in equipment exposed to corrosive environments are commonly protected against corrosion by application of various coatings. The more effective protective coatings are obtained by anodizing (chromic or sulfuric acid treatment) or alodizing (chromate treatment) of the aluminum alloys. For certain structural designs, anodized or alodized aluminum alloys may be used in contact with 347 CRES (corrosion resistant stainless steel) or 6 Al – 4V titanium alloy. In such instances, there is the possibility of galvanic corrosion, due to electrochemical coupling between the dissimilar metals when the surface coatings are not sufficiently protective or break down in corrosive atmospheres. A study was therefore made to establish the quality of chemical and galvanic protection afforded by anodized or alodized coatings applied to test panels of various aluminum alloys. The study was carried out by placing the test panels in firm contact with panels of 347 CRES and 6 Al – 4V titanium alloy. All pairs of the panels were subjected to the standard ASTM salt spray test for various periods, after which they were visually examined for corrosion effects.

1. Sulfuric acid-anodized coatings provided the best protection.

2. Both anodic coatings (sulfuric acid or chromic acid treatment) when properly applied to the aluminum alloys were impervious to the salt spray. Since these impervious coatings are also poor electrical conductors, they prevented the formation of galvanic couples between the aluminum alloy and the 347 CRES or 6 Al – 4V titanium alloy.

3. In those cases in which the anodized or alodized coatings broke down in the salt spray, the degree of galvanic corrosion varied with the electrochemical potential of the aluminum alloy, relative to the 347 CRES or 6 Al – 4V titanium alloy.

4. Alodized (chromate) coatings, although capable of protecting aluminum alloys not in contact with more anodic metals, did not prevent galvanic attack of the coated aluminum alloys coupled with 347 CRES or 6 Al – 4V titanium alloy. This lack of protection is due to the fact that the chromate coating is a relatively good electrical conductor and thus permits the establishment of an electrochemical potential between the dissimilar metals in the presence of salt spray (or other electrolyte).

### Note:

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