

Chromate-Free Corrosion Inhibitors

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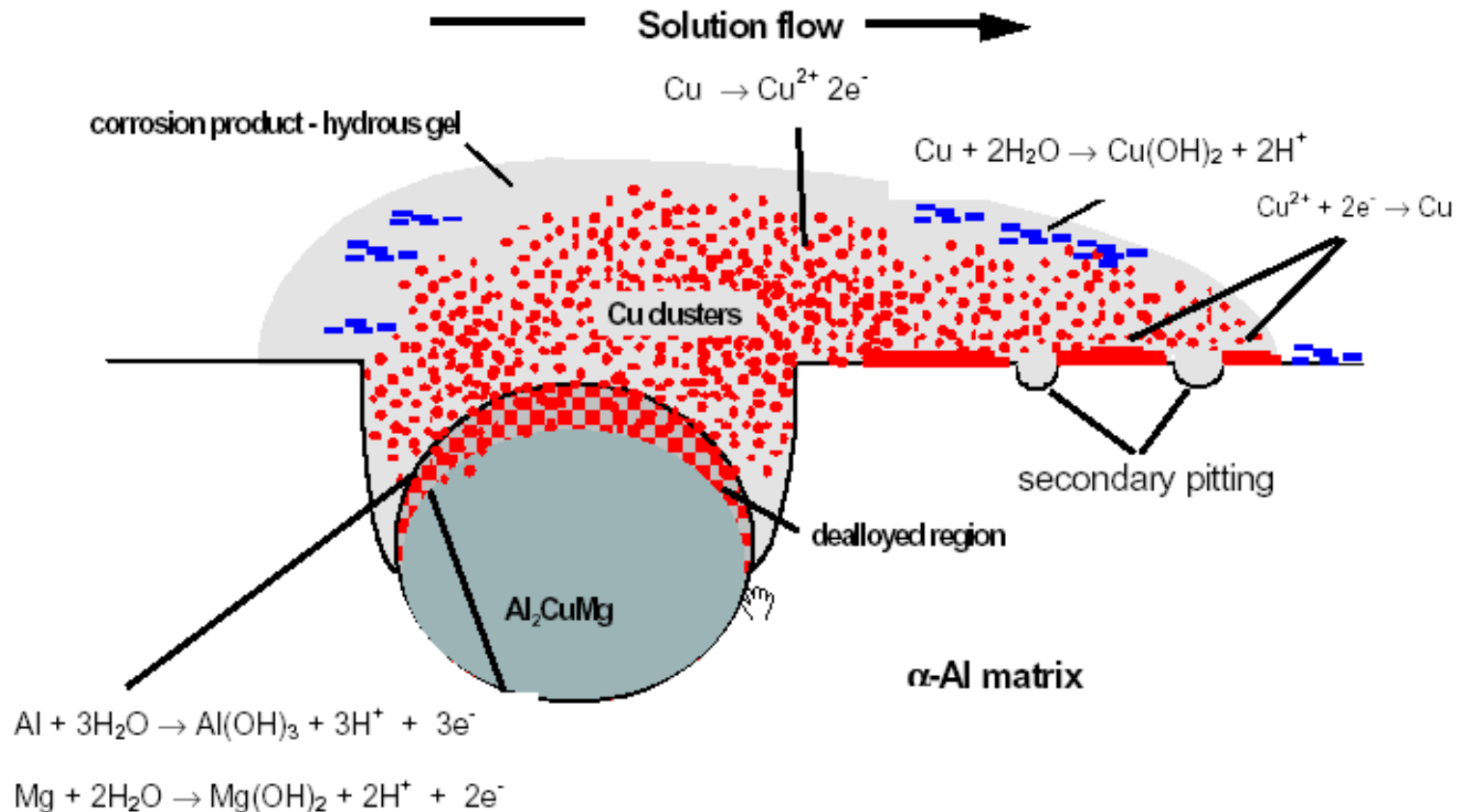
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Problem

- High strength, light-weight Al-Cu alloys (Al-2024, Al-2219, Al-2519, Al7075)
- Widely used to achieve superior performance in DOD missions
- The copper additives are the source of poor corrosion performance

Pictorial View of Al-Cu Corrosion



From Buchheit and Boger 2001

Baseline Technology

- Only hexavalent chromates have provided acceptable corrosion protection
- Chromates are highly toxic
- Their use is being regulated in the US and banned overseas

TDA's Approach

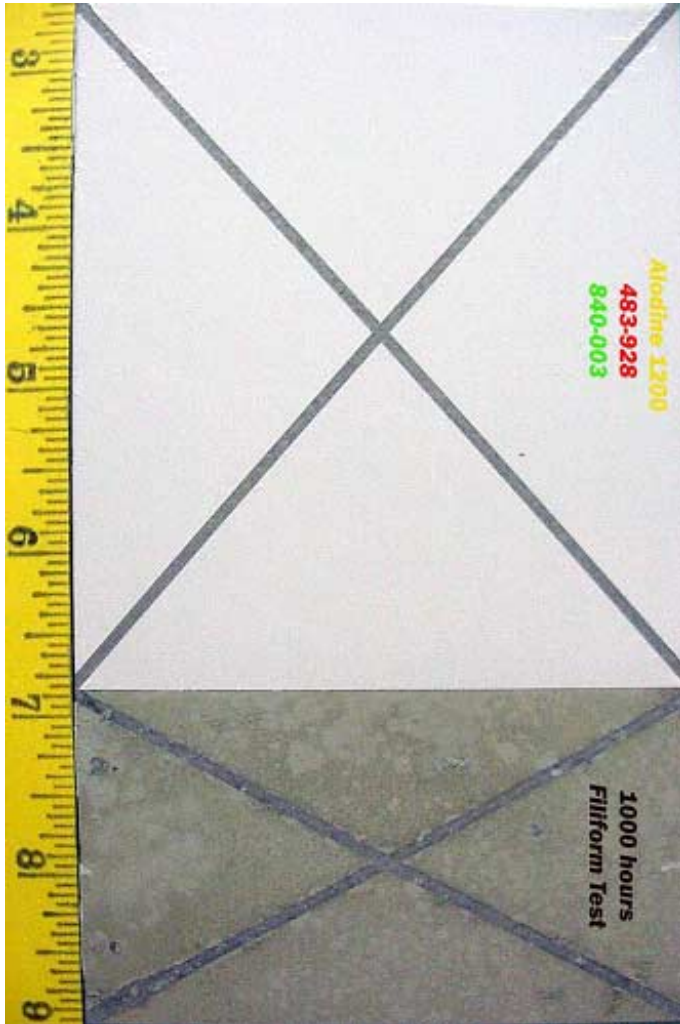
- Non-toxic organic corrosion inhibitors
 - Inhibit copper dissolution/deposition reaction
 - Inhibit copper cathodic depolarization that drives the anodic Al dissolution reaction
- Inhibitors attached to nanoparticle additives in surface coating
- Inhibitors release on demand (triggered release)

Advantages of TDA's Nanoparticle Corrosion Inhibitors

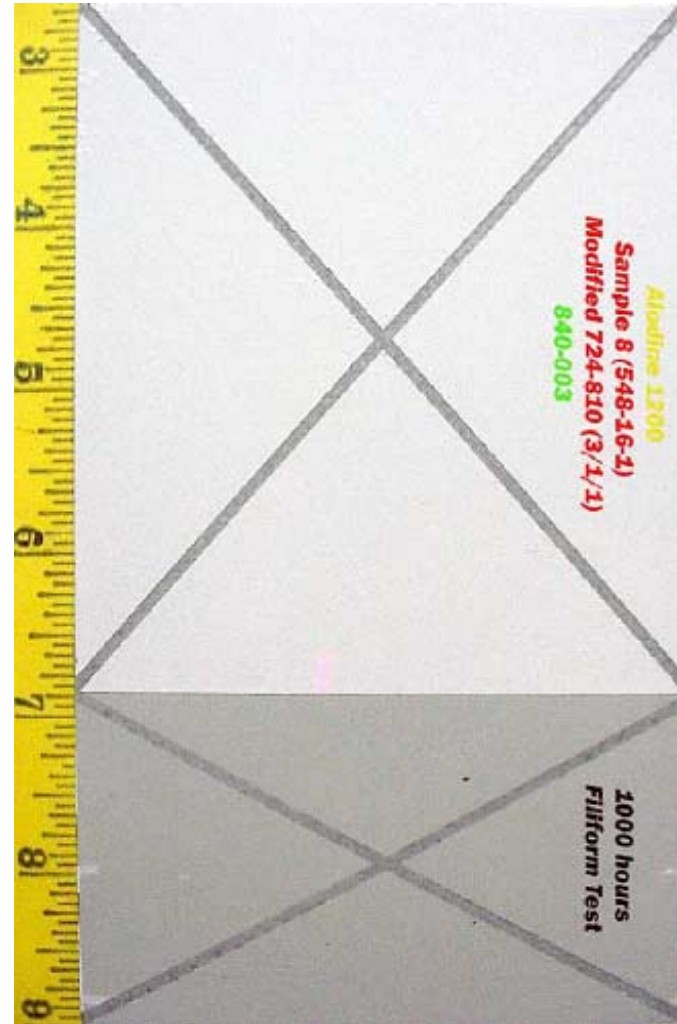
- Excellent passive and active corrosion protection for Al 2024 and Al 7075
- Work in water, solvent, and high-solids formulations
- Are effective at 0.5-wt% loading (versus 40-wt% for chromates)
- Passed 3000 hrs salt-fog test and 1000 filliform corrosion test (see the next two slides).
- **Other non-chromate corrosion inhibitors**
 - Failed filliform corrosion test (<250 hours).
 - Performed poorly on the salt fog test.

Al-2024 Filliform Corrosion Test (1000hr) Comparison with 40% Chromate

Alodine 1200 / 40%Chromate

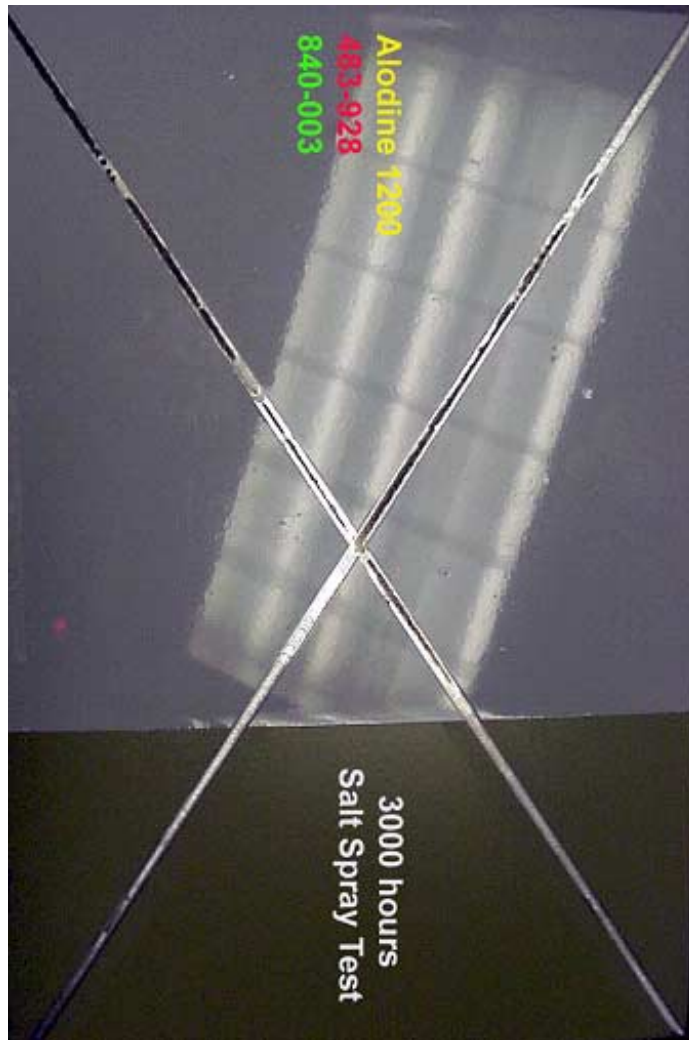


Alodine 1200 / 0.5% NanoCl

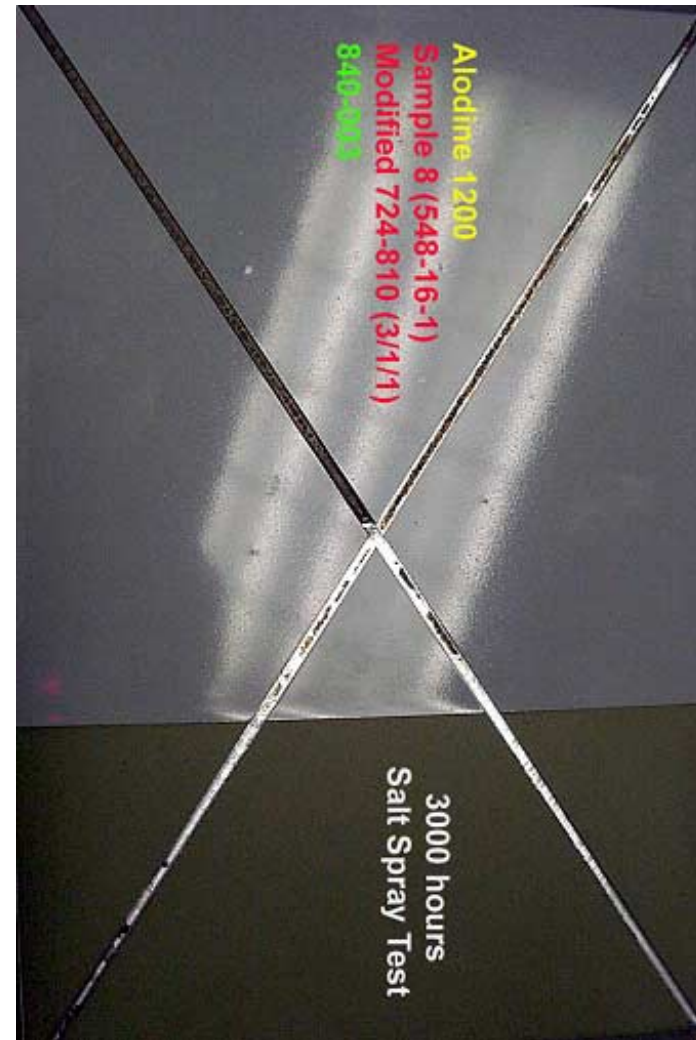


Al 2024 Salt Fog Corrosion Test (3000hr) Comparison with 40-wt% Chromate

Alodine 1200 / 40%Chromate



Alodine 1200 / 0.5% NanoCl



Current State of Development

- Epoxy formulations with TDA's corrosion inhibitors tested in house and by commercial partners of Al 2024 and Al7075
- Other aluminum alloys and steel are under study
- Project currently on hold due to lack of funding
- **TDA's is interested in funding to complete development and bring this product to the market.**