Non-Chrome Alternatives Stress Corrosion Cracking Assessment

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Team Members

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  - **Mike Spicer**
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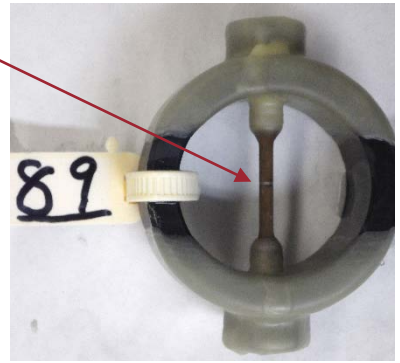
Objective

- **Goal of effort was to develop a qualitative test methodology for assessing stress corrosion cracking (SCC) susceptibility for organic coating systems**
  - **Method involved using 7075-T6 aluminum axial smooth bar specimen with simulated “damage” to the coating**
    - **Rubber band used to mask area at center of specimen gage section**

Constant Load Testing

Masked area used as simulated damage to coating system



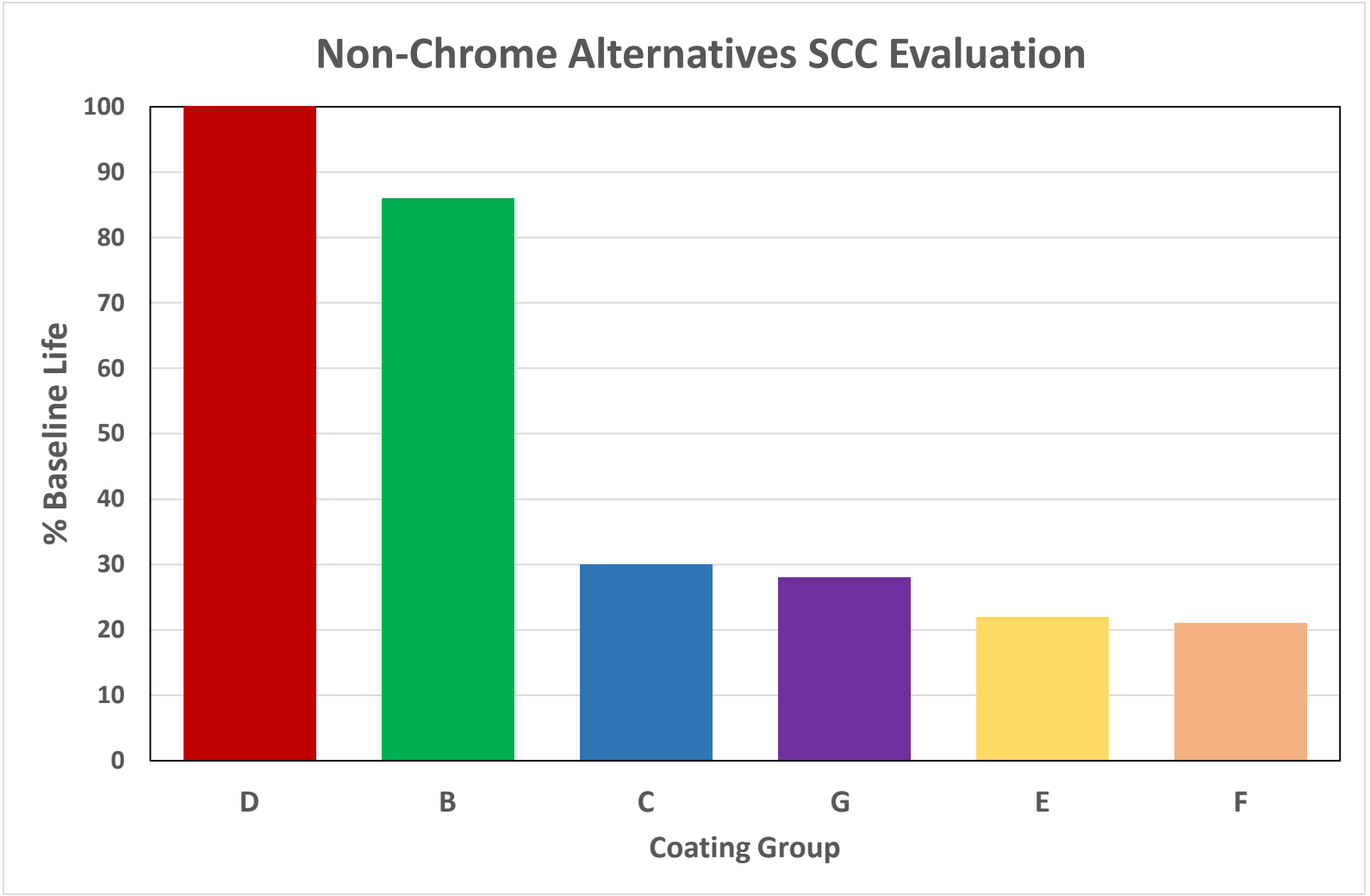
- **Specimens were pre-stressed in ring loading fixtures at 85% of the yield strength**
  - **No torque applied through nuts. Loading applied to ring, nuts hand-tightened**
  - **85% was selected after initial trials at 75% (plus step loading) resulted in lengthy failure times**
  - **An extensometer was used during specimen loading to measure strain directly**
  - **Ring/specimen assembly was wax dipped prior to immersion to reduce oxidation of the threads and fixture**
- **Specimens were exposed in alternating immersion (10 mins wet/50 mins dry) in 3.5% NaCl solution.**
  - **Digital images were captured each hour to allow 24/7 testing**
  - **NaCl solution was drained/replaced every 500 hours. Salinity was found to increase ~0.5% over the course of 500 hours**

Coating Systems

- **Pretreatments**
  - **PreKote – chrome-free adhesion promotor, no corrosion inhibitor**
  - **RECC 1043/3024 – chrome-free, rare earth corrosion inhibitors**
  - **Alodine 5200 – chrome-free conversion coating**
  - **EAP9 – chrome-free sol-gel adhesion promotor, no corrosion inhibitor**
- **Primers**
  - **Deft 02Y040 – epoxy, strontium chromate inhibitor, qualified to MIL-PRF-23377 (Control)**
  - **Deft 45GY005 – chrome-free epoxy, no corrosion inhibitor**
  - **Deft 02GN093 – chrome-free epoxy, rare earth inhibitors**
  - **Akzo Nobel AE2100 – chrome-free epoxy, Mg-rich inhibitors**
  - **Hentzen 53055GEP – chrome-free epoxy, Wayne Pigments inhibitors**
  - **PPG CA7236 – chrome-free epoxy, Mg-oxide inhibitors**
- **Topcoats**
  - **Deft 99GY001 – polyurethane, qualified to MIL-PRF-85285 Type IV**
  - **Hentzen 35515APX – polyurethane, qualified to MIL-PRF-85285 Type IV**
  - **PPG CA9311 – polyurethane, qualified to MIL-PRF-85285 Type IV**

Group	Pretreatment	Primer	Topcoat
D	PreKote	Deft 02Y040	Deft 99GY001
B	PreKote	Deft 45GY005	Deft 99GY001
C	PreKote	Akzo Nobel AE2100	Deft 99GY001
G	EAP9	PPG CA7236	PPG CA9311
E	RECC 1043/3024	Deft 02GN093	Deft 99GY001
F	Alodine 5200	Hentzen 53055GEP	Hentzen 35515APX

Results



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Conclusions/Path Forward

- **Results of this testing indicate that Groups C-G have higher susceptibility to SCC as compared to the coating system with the chromate primer (Group D)**
  - **Group B system susceptibility nearly equivalent to Group D**
- **This type of testing is only intended as side-by-side comparison study**
  - **Not necessarily relevant to real world behavior of coating stack ups**
- **Structural Component Corrosion Simulation (SCCS) program is being developed to better evaluation systems under “real world” conditions**
  - **Protocol still in development and evaluation**