Corrosion Inhibitors vs Oxidizing Agent

By: Colin Jones
Overview

• Objective

• Procedure
  • Materials

• Calculations & Results

• Discussion
  • Validity of Experiment
Objective

• Verify material composition through hardness testing
  • Inconclusive

• Measure material loss due to “uniform” corrosion
  • American Society for Testing and Materials (ASTM) standard

• Calculate corrosion rates

• Analyze impact of treatment on corrosion rate
Procedure

• Materials
  • Steel specimens
    • ASTM A569
    • <0.15% carbon
  • Oxidizing agent
    • Hydrogen peroxide, salt, vinegar
    • 16oz / 0.5 tbsp / 2oz
  • Testing peripherals
    • Scale, abrasive pad, spray bottle

• ASTM G1-03
  • Mass and dimensions
    • 6.5 – Sig Figs
  • Specimen designation
    • 6.2 - Methods
    • 6.2.5 – Galvanic interactions
  • Mechanical corrosion removal
    • 7.1.1 – Abraded control specimen
### Calculations

**Corrosion Rate**

\[
Corrosion\ Rate = \frac{K \times W}{A \times T \times D}
\]

**Variable Identification:**

- \( T \) = time of exposure in hours
- \( A \) = area in cm\(^2\)
- \( W \) = mass loss in grams
- \( D \) = density in g/cm\(^3\)

\( K = 8.76 \times 10^{-7} \) (ASTM G1-03) - mm/year

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<tr>
<th>Sheet Name</th>
<th>Material</th>
<th>Initial Mass Adjustment (g)</th>
<th>Length (cm)</th>
<th>Width (cm)</th>
<th>Taped Width (cm)</th>
<th>Thickness (cm)</th>
<th>Mass of Saturated Tape (g)</th>
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Average Corrosion Rates

Control specimens

- 220 CTRL
  - 3.70 mm/year

- CTRL
  - 3.93 mm/year

Treated specimens

- CB
  - 3.65 mm/year

- CRC
  - 4.52 mm/year

- CX
  - 3.50 mm/year
Corrosion Rate vs Time Plots

- **Corrosion Rate vs Time Exposed Specimen 220 CTRL**
- **Corrosion Rate vs Time Exposed Specimen CTRL**
- **Corrosion Rate vs Time Exposed Specimen CX**
- **Corrosion Rate vs Time Exposed Specimen CB**
- **Corrosion Rate vs Time Exposed Specimen CRC**
Discussion

• Experimental success
  • Consistent corrosion rates

• Experimental short-sights
  • Abrasion skewing results?

• Improve data by reducing scope to one product
  • Unadulterated measurement of inhibitor effectiveness
  • Show non-linearity of corrosion rate
References

• American Society of Testing Materials G1-03, *Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens*, ASTM International


Anyone Still Awake?