Corrosion Inhibitors vs Oxidizing Agent

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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

CRC
Marine
Heavy Duty
Corrosion
Inhibitor
WESTCOTT

Sharpie
FINE POINT
Marker
0 inch
WESTCOTT

220 CTRL
220
CTRL

CX
CX

CB
CB
CRC

CTRL
CTRL

CRC
CRC

Calculations

$$Corrosion\ Rate = \frac{K * W}{A * T * D}$$

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 x 10^4 (ASTM G1-03) - mm/year

Final Adjusted Measurements - Accounting for Tape and Zip Tie							
Sheet Name	Material	Initial Mass Adjustment (g)	Length (cm)	Width (cm)	Taped Width (cm)	Thickness (cm)	Mass of Saturated Tape (g)
220 CTRL	A569	-2.5	30.400625	30.48	23.33625	0.156	2.48
CTRL	A569	-2.5	32.940625	30.48	23.1775	0.159	2.56
CB	A569	-2.5	32.940625	30.48	23.01875	0.15	2.55
CRC	A569	-2.5	32.940625	30.48	23.01875	0.15	2.57
CX	A569	-2.5	32.940625	30.32125	23.1775	0.156	2.51

Specimen - 220 CTRL												
Material	Initial Mass (g)	Length (cm)	Width (cm)	Taped Width (cm)	Thickness (cm)	A Area (cm^2)	D Density (g/cm^3)	T Time Exposed (hour)	Mass (g)	W Mass Loss (g)	K	Corrosion Rate (mm/year)
A569	1054.6	30.400625	30.48	23.33625	0.156	709.4365852	7.295678602	1	1058.1	0.08	87600	1.35398801
A569	1054.6	30.400625	30.48	23.33625	0.156	709.4365852	7.295678602	2	1057.7	0.48	87600	4.061964029
A569	1054.6	30.400625	30.48	23.33625	0.156	709.4365852	7.295678602	3	1057.5	0.68	87600	3.836299361
A569	1054.6	30.400625	30.48	23.33625	0.156	709.4365852	7.295678602	4	1057.2	0.98	87600	4.14658828
A569	1054.6	30.400625	30.48	23.33625	0.156	709.4365852	7.295678602	5	1056.9	1.28	87600	4.332761631
A569	1054.6	30.400625	30.48	23.33625	0.156	709.4365852	7.295678602	6	1056.6	1.58	87600	4.456877199

Average Corrosion Rates

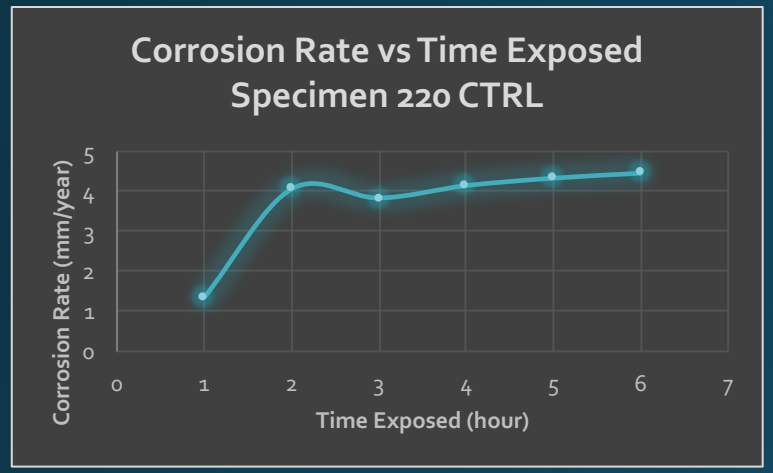
Control specimens

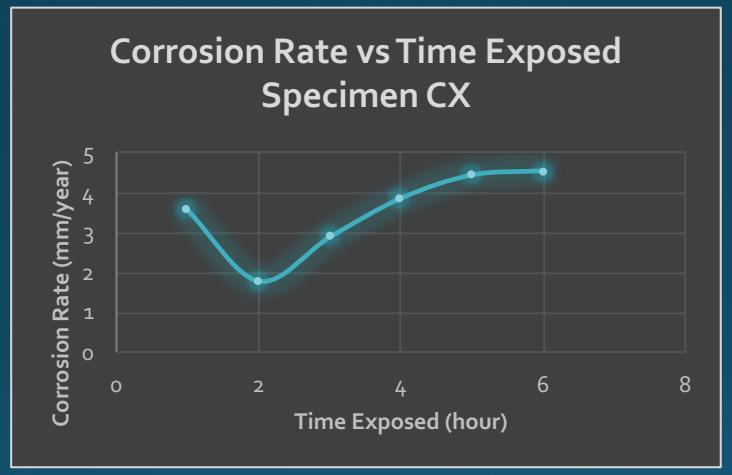
- 220 CTRL
  - 3.70 mm/year
- CTRL
  - 3.93 mm/year

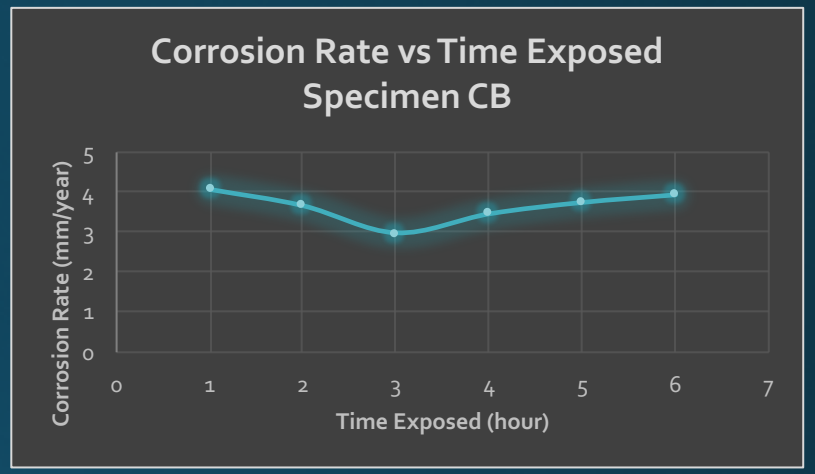
Treated specimens

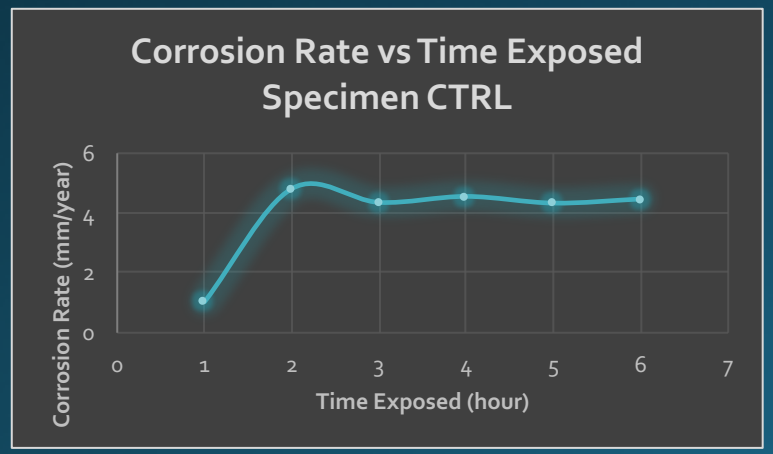
- CB
  - 3.65 mm/year
- CRC
  - 4.52 mm/year
- CX
  - 3.50 mm/year

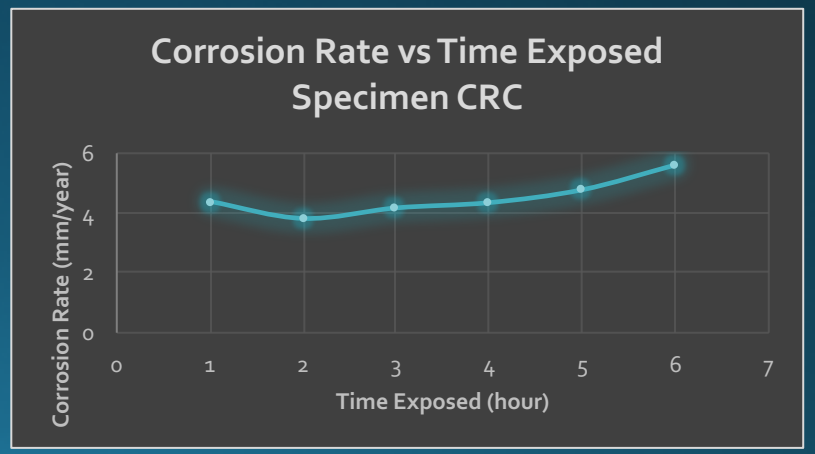
Corrosion Rate vs Time Plots











Discussion

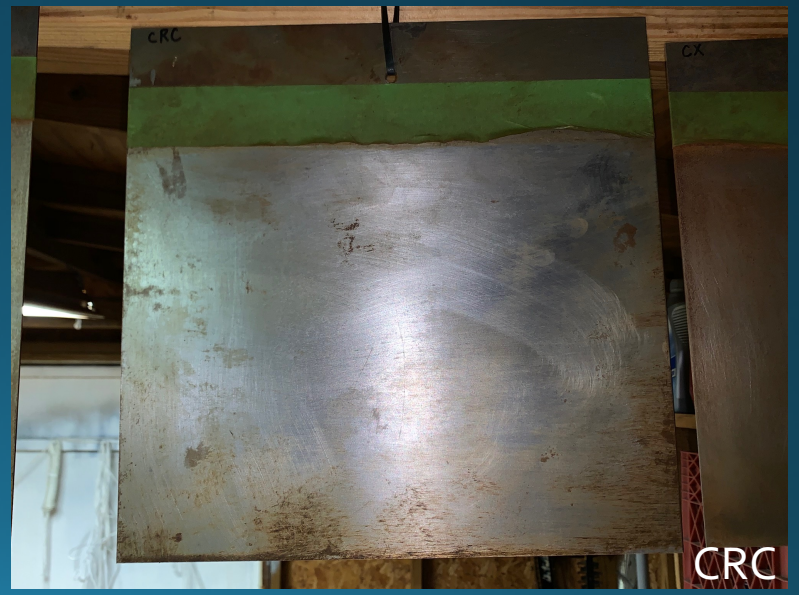
- Experimental success
  - Consistent corrosion rates
- Experimental short-sights
  - Abrasion skewing results?
- Improve data by reducing scope to one product
  - Unadulterated measurement of inhibitor effectiveness
  - Show non-linearity of corrosion rate

220 CTRL

CX

CB

CTRL



CRC

References

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Anyone Still Awake?