

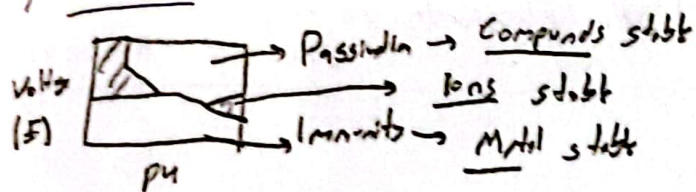
Costs:

- Direct → Maintenance, Labor, Downtime...
- Indirect → Downtime, Contamination...
- Recoverable → R&D, Material Selection...

Weight Change mdd

Dissolution Change mdd
Material Property Change

Pourbaix



EMF → $\frac{+}{-}$ / more negative → anode

$\Delta G \rightarrow$ $\begin{matrix} + \rightarrow \text{no rxn} \\ - \rightarrow \text{rxn possible} \end{matrix}$

Galvanic Series → E_{corr} , $+0.5$, specific environment

Uniform → continuous layer, whole surface

Galvanic → dissimilar metals

Crevice → limited oxygen in cracks, under bolts

Pitting → Stainless Steel

Dealloying → Dezincification, Graphitization, Porous structure

Intergranular → Microscopic, in weld zones

Erosion → Environment velocity

Corrosion → bubbles

Stress cracking → Joint action

Hydrogen Embrittlement → atomic hydrogen penetrating metal

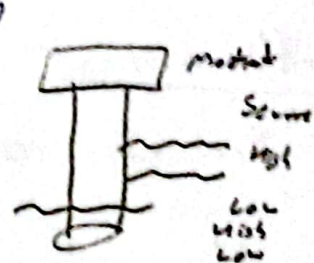
Fretting → (Abrasion) Moving metal surfaces

Stray-current →

MIC → SRB

Filiform → Detail in coating

Moist > Dry
Hot > Cold
Polluted > Clean
Salt > Fresh
Acid > Base



Corrosion Types

- Chemical
- Electrochemical
- Physical

Fundamentals → $I \propto \text{Corr}$

Ohm → $V = IR$

PH

< 7 → acidic, low pH > 10

< 7, Al → high → high

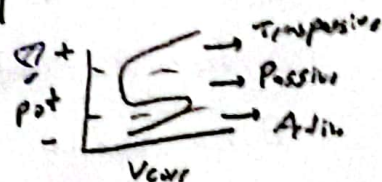
Anode → $X \rightarrow X^{2+} + 2e^-$ (Oxidation)

Cathode → $X + Y + e^- \rightarrow XY$ (Reduction)

Nernst: non-standard conditions

($R = 8.314$)

$\frac{E}{R} \sim V_{corr}$



Carbon Steel → Uniform

Pitting
Galvanic
Stress cracking

Aluminum → Pitting

Galvanic

Stainless Steel → Galvanic

Pitting

Crevice

Copper → Erosion

Dealloying (selective)

PREVENTION

- < Preliminary des.
- < Construction
- < After const.
- < Life time

Material sel.
Good Design
Paint, coating
Cathodic protection
Inhibitor
Anodic passivation

- ① Paint and Coating
Surface prep. quality $\uparrow$ Best coating
Paint
- ② Metallic Coating (Galvanizing)
Sacrificial mode (Zn, Sn, Al)
- ③ Cathodic Protection $\rightarrow$ Tuya
Paint not affected by alkaline
ICCP vs SACP
- ④ Inhibitors
Absorption
Hydrogen evolution Poisons
Scavengers
Oxidizers
Vapor phase $\rightarrow$ condensed
- ⑤ Anodic passivation $\rightarrow$ Simple
 $\rightarrow$ Chloride ion breaks it

$$I = \frac{A \cdot j}{1000}$$

$$W = \frac{I \cdot N \cdot 8760}{C}$$



$\rightarrow$ %15-30, > 400000 down
 $\rightarrow$ 4m apart max.

Electrolytic Descaling $\rightarrow$ %60, Mg Strips

Surface Prep. $\rightarrow$ Tagloma, Smoothing

Surface Pre-treatment $\rightarrow$ Mechanical vs Blasting

Barrier Coating

Antifouling Coating

(For detergents $\rightarrow$ Low Pressure $\rightarrow$ 340 bar
Water)

== Dry
== Sh.
== Wet
== UNIPWJ $\rightarrow$ 2500 bar
Wash $\rightarrow$ 7 kg/cm²
Abrasives $\rightarrow$ Grit

PAINT

- < Physical Drying
- < Oxidatively Drying
- < Chemically Drying

VOC $\downarrow$ Solid $\uparrow$ DFT $\uparrow$ WFT $\downarrow$

Shop primer $\rightarrow$ 6-9 g, %20-30 solid

PSPC $\rightarrow$ 2017, 15 years

Coating Direct $\rightarrow$ %2
cost
Indirect $\rightarrow$ %8-10

Hydrojetting $\rightarrow$ %20 slower than blast

Blasting agent consumption $\rightarrow$ 250 kg/h

Binder $\rightarrow$ provides adhesion, cohesion, flexibility

Breast test $\rightarrow$ Determine salt

X cut test $\rightarrow$ Performed for DFT above 125 microns

ICCP System $\rightarrow$ Permanent Anode, Potronic anodes, Rectifier, Slip ring, brushes, earthing cable

Painting $\rightarrow$ RH $\downarrow$ %85
Temp $\uparrow$ 5° New Paint

IMO TBT Paint Ban $\rightarrow$ 2008