Computer Aided Analysis in corrosion prevention: from *find-it/fix-it* to *predict&manage*

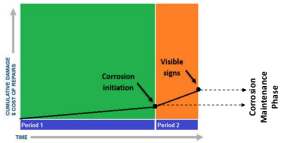
INTRODUCTION

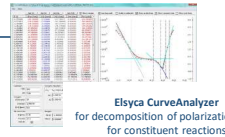
It is hard to believe that in XXI century when an access to the most advanced technological solutions is easily available, the program management guide for corrosion prevention and control still relies on a combination of galvanic tables from several sources, noting the importance of relative areas which is still based on rule of thumb. The problem is more complicated since already galvanic corrosion rate is determined by corrosion current, which in turn is a complex function of materials, electrochemical properties, corroding electrolyte chemistry and the geometry of an entire assembly that includes anodic and cathodic materials. As in the past such complex problem could not be addressed, nowadays, a combination of an advanced electrochemical simulation technology and 3D CAE/CAD design tools enable engineers to quickly assess the impact of design strategies and material choices on corrosion resistance. The content shown below introduce a new technological trend in corrosion risk assessment, which relies on solving the electrochemical currents in any assembly by incorporating its materials, coatings, and exact design, leading to the lifetime prediction and informed decisions on design, material performance, cost, operational integrity and maintenance requirements. The technology is based on a computer modelling approach, enabling to predict galvanic and uniform corrosion risks and rates even on the most complex mechanical assemblies of mixed materials. The presented **Elsyca CorrosionMaster** simulation technology has been developed in close co-operation with the industry and has been embraced by the US DOD for further research and development for the Navy assets.

Find-it / Fix-it → Predict & Manage

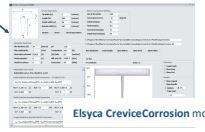
- *No Design Engineering Policy on corrosion mitigation & control*
- *Corrosion control as an "after-thought process"*

- *Apply Corrosion Engineering as a policy in all acquisitions*
- *Use proper prediction models and software as a performance and maintenance tool*





Elsyca CurveAnalyzer for decomposition of polarization data for constituent reactions



Elsyca CreviceCorrosion module

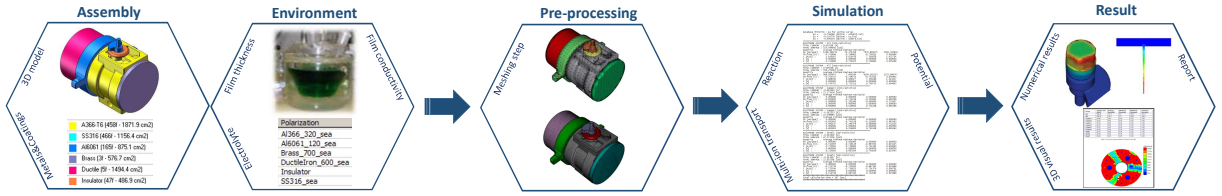
1. DESIGN

COMPATIBLE GROUPING OF METALS

GROUP	METALS
I	MAGNESIUM/MAGNESIUM ALLOYS; ALUMINUM/ALUMINUM ALLOYS; TIN
II	ALUMINUM; ZINC; CADMIUM; TIN; TIN-LEAD
III	ZINC; CADMIUM; STEEL; LEAD; TIN; NICKEL/NICKEL ALLOYS; TIN-LEAD; TITANIUM
IV	COPPER/COPPER ALLOYS; NICKEL/NICKEL ALLOYS; CHROMIUM; STAINLESS STEEL; GOLD; SILVER; TITANIUM

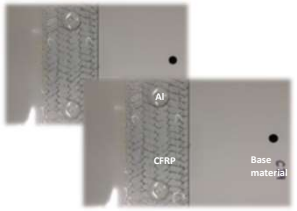
Follows recommendations:

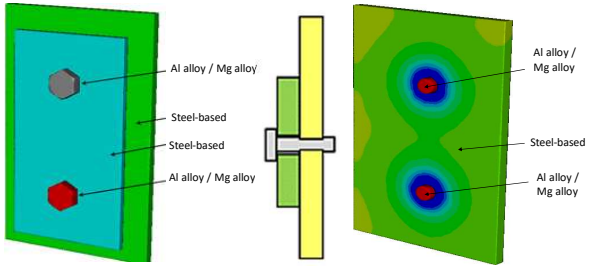
a. Metals in Group I corrode the fastest.
b. Metals in Group IV are the most resistant to corrosion.
c. If you must mix metals, try to use metals from the same Group.
d. If above is not possible, select the metal with the smallest area from the lower activity Group (III & IV).
e. If allowed, use sealants as primers to isolate the metals.



Parameter	Environment A	Environment B
Water film type	High salinity	Low salinity
Film conductivity, S/m	4.0	0.1
Film thickness, mm	1	1

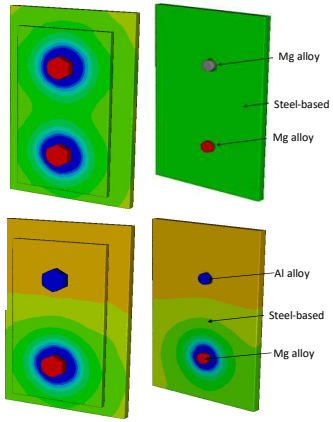
2. FABRICATION



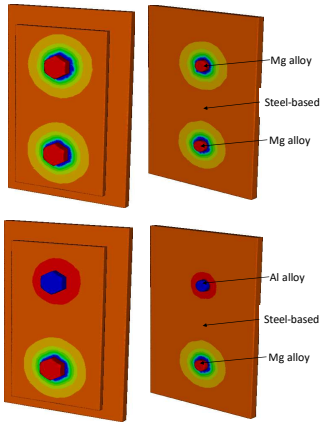


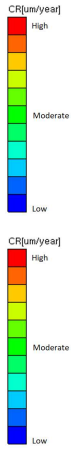
Pre-processing → Simulation

Simulation result - NaCl

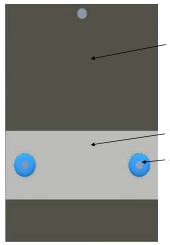


Simulation result – Tap water

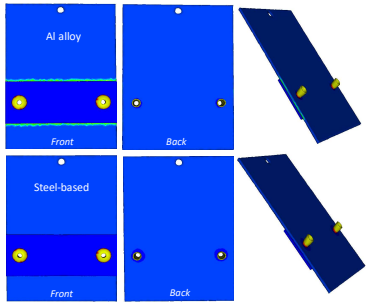


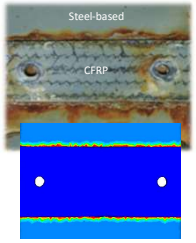


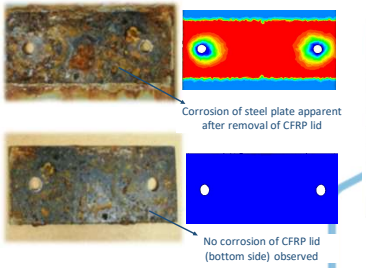
3. SERVICE

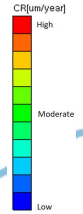


Pre-processing → Simulation



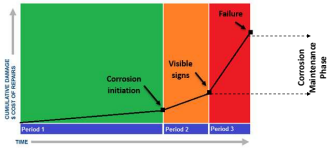






3. MAINTENANCE

- **LORA** (Level of Repair Analysis) process
  - **O**(rganizational)-**level**: R&R (Remove&Repair), RIP (Repair-in-Place)
  - **I**(ntermediate)-**level**
  - D(epot)-**level**



***Take-me-home* message**

Interested in corrosion simulation approach dedicated to industrial applications rather than fundamental studies? We have what you need! Visit www.elsyca.com and look for Corrosion Design Engineering – Elsyca CorrosionMaster.

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