



### AVT-373 Research Specialists' Meeting on "Emerging Technologies for Proactive Corrosion Maintenance"

# MIL-STD-889 and the Impacts on Corrosion Prevention

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# Background

Purpose: This standard defines and classifies dissimilar conductive materials and establishes requirements for protecting coupled dissimilar materials against corrosion with attention directed to the anodic member of the couple.



The last technical revision was done in 1967, based on an AMCOM report (TR-67-11). Was not done in sea water.



Modernized Revision: Current version was modernized in 2016 to replace obsolete references to other standards

MIL-STD-889D

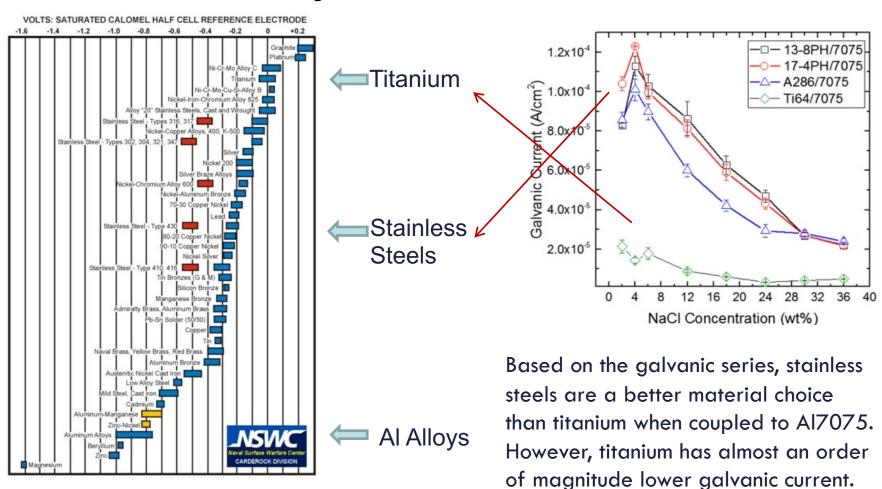


Current Approach: This approach is to move to galvanic current, rather than potential, in order to determine galvanic compatibility.





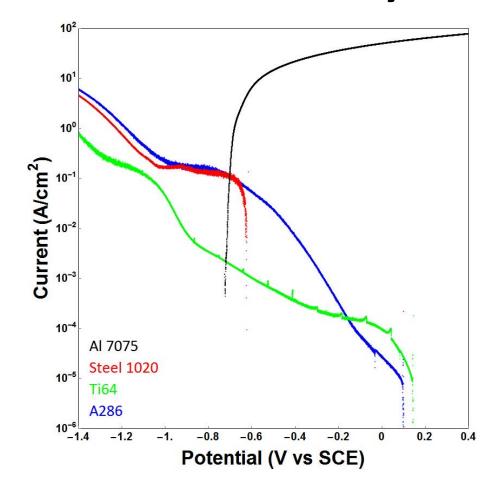
### Why Shift to Kinetics?







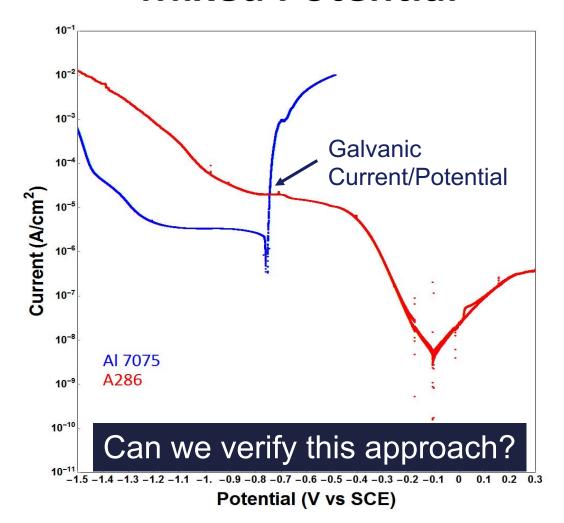
### **Kinetics Tells the Story of Rate**







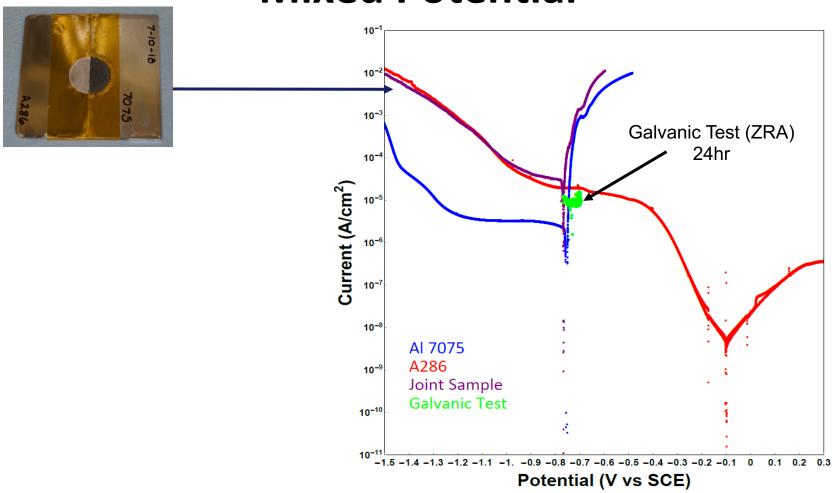
### **Mixed Potential**







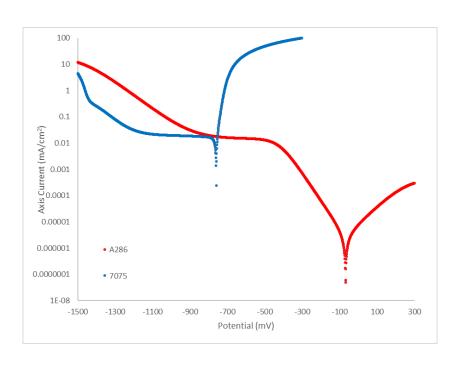
### **Mixed Potential**

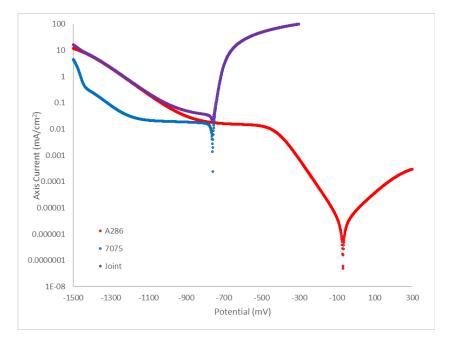






### Summation vs. Intercept

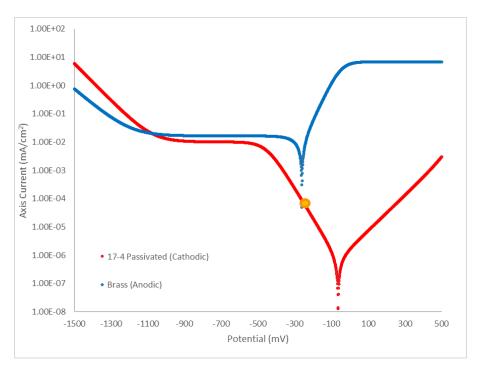


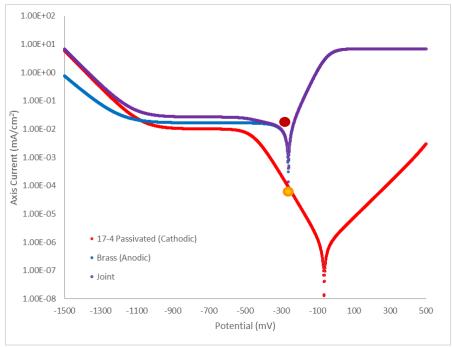






# **Discrepancies Near OCP**









### MIL-STD-889 Compatibility Table

Legend: Galvanic compatibility between two conductive materials of interest is found at the intersection point of the row and column. The anodic member of the couple is listed in the rows and the cathodic member of the couple is listed in the columns. An empty cell at the intersection point indicates that the conductive material identified as anodic and cathodic should be switched. This table shall not be used to indicate the level of risk associated with the galvanic couple nor shall it be used to determine the level of protection required to protect the conductive materials. The CEA or appropriate design authority shall determine the necessary protection. The corrosion rate was determined for conductive materials in a 1:1 surface area ratio. The number in the cells represent a range at which the anodic material will corrode when coupled with the cathodic material in artificial seawater. Any number above zero indicates galvanic incompatibility. The range of the corrosion rate in mil/year is as follows:

#### **Galvanically Compatible:**

0: <0.009 mil/year

#### Galvanically Incompatible:

- 1: 0.01-0.09 mil/year
- 2: 0.1-0.9 mil/year
- 2. 0.1 0.0 1111/ y 00
- 3: 1-4.99 mil/year
- 4: 5-9.99 mil/year
- 5: 10-99.99 mil/year
- 6: > 100 mil/year

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MIL-STD-889, Table 1, August 2021.



### MIL-STD-889 Database

All data that was collected by our lab can be found on DAU CPO site

https://www.dau.edu/cop/cpc/Pages/Topics/Information-Sharing.aspx

Interactive tool that displays MIL-STD-889 Data (Developed by LUNA Innovation, Inc.

https://acuitycorrosion.com/products-2/galvanic-compatibilitytool/



### What about materials not in the table?

- 1. Talk with your Cognizant Engineering Authority
  - a. Can you use a comparative material or do you need to collect the data?
- 2. Does your facility have the capability to collect the data or do you need to reach out to a third party?
  - a. Industry Partner
  - b. NAWCAD CPCS

Note: Physical data collection is required. Model-based data is not accepted at this time.



### Where do we go from here?

- Gather more data
  - ➤ Various alloys
  - > Different environments (atmospheric/thin film, industrial, etc.)
  - ➤ Model-based data
- Start using the standard
- Track sections that require changes in future revisions





### What has the feedback been thus far?

### Confidence

➤ Corrosion engineers are more confident they are providing accurate galvanic corrosion pairings

### Uncertainty

➤ Engineers and scientists unanimously agree that this shift is scientifically stronger but are unsure about implementation

#### Interest

➤ Bi-monthly, a working group discusses use of standard and plans for future revisions/additions.





### **Questions?**

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