CORROSION EVALUATIONS

I. Standard Immersion Test

In this test individual samples are completely submersed in your chosen corrosive solution. Five weeks is the absolute minimum for this test, longer times will produce more distinctive results and five weeks should be considered as a standard. Remove the samples at intervals to record change in mass, along with any qualitative observations you may have. Use several samples so that you may remove one sample after each predetermined period. You may immerse into any environment relevant to the use and performance of your alloy. Remember that relevant is the key term here.

II. Planned Interval Immersion Test

Although this test is more involved than the simple immersion test, it will provide important additional information. This test indicates which alloys corrode faster, whether the alloy becomes more susceptible to corrosion or not over time, and determines if the environment is more or less severe with time. Five weeks are required for this test. Four individual specimens of each material are required to run the complete series of tests.

1. The first specimen is exposed for 1 week. (measure the weight loss – A1)
2. A second specimen is exposed for 4 weeks. (measure the weight loss – A2)
3. A third specimen is exposed for 5 weeks (measure the weight loss – A3)
4. A fourth specimen is immersed in the solution only, after 4 weeks for one week. (measure the weight loss, B)

Calculate A3 - A2 = A', and compare the values of; A1 and B, and A' and B:

B=A1, the corrosiveness of the environment on the alloy is unchanged with time.
B>A1, the environment becomes less severe as corrosion proceeds.
B<A1, the environment becomes.

A'=B, the alloy corrodenibility remains unchanged with time.
A'>B, the alloy corrodenibility decreases with time.
A'<B, the alloy corrodenibility increases with time.

III. Cyclic Test

Acid rain Corrosion test Environments

♦ GM Automotive corrosion test (GM 9540P/B)
0.9w% NaCl + 0.1w% CaCl₂ + 0.25w% NaHCO₃ (pH 6.0-7.0)

♦ Japanese Automobile Standard (M609)
5w% NaCl + 0.12v% HNO₃ + 0.173v% H₂SO₄ + 0.228w% NaOH (pH ~ 3.5)
1. Mist with solution
2. Ambient of 30-50% relative humidity for 1.5 hours
3. Ambient of 98-100% relative humidity for 8 hours
4. Dry at 60°C for 8 hours
5. repeat cycle for a total of 1970 hours

IV Cleaning Corrosion from Metals

Use these solutions to remove corrosion products from the corroded metal. To determine the mass loss from corrosion, subtract the weight of the cleaned metal from that of the initial metal

**Al, Al alloys:**
70% HnO3 for 2-3 minutes at room temperature followed by light scrub
2% CrO3 and 5%H3PO4 solution for 10 minutes at 175 -185°F

**Cu, Cu alloys:**
15-20% HCl for 2-3 minutes at room temperature followed by light scrub.
5-10% H2SO4 for 2-3 minutes at room temperature followed by light scrub.

**Fe, steel:**
20% NaOH + 200g/l zinc dust, boiling for five minutes, follow with light scrub.
Concentrated HCl + 50g/l SnCl2 + 20 g/l Sb3Cl3 cold solution until clean

V Corrosion Rate determination:

**Weight loss/year**
**mpy or ipy**, Rather than expressing corrosion as a weight loss per unit time, you may express it as a penetration rate (inch/year, or mil/year)

\[
\text{mil/y} = \frac{534 \ W}{\rho \ A \ t}, \text{ where } W \text{ is the weight loss in miligrams; } \rho \text{ is the density of the alloy in g/cm}^3; A \text{ is the area in inches; } t \text{ is the time in hours}
\]

**Note:** Some careful thought should be given to the preparation of each of your samples before you begin. What is the relationship between surface area, mass and the corrosive environment? Do your particular samples have any surface coating that may affect how they react to the solutions? Are there any surface irregularities that that will affect your evaluations?