## Corrosion in Stainless Steel

Corrosion on stainless steel is not readily or visibly apparent, as is the case with carbon steel, it is assumed that stainless will not corrode. It is true that some types of stainless steel are *resistant* to corrosion, however when stainless is exposed to certain conditions it will corrode.

### Stress Corrosion:

There are three basic reasons for stress corrosion cracking. Mechanical, metallurgical and environmental.

Mechanical cracking can occur from lifting loads or vibrations while the part is in service. High stresses applied to the metal (in this case stainless) parts in a corrosive environment can cause the cracking to be accelerated

Metallurgical cracking can be from problems with the grain structure of the material itself with improper heat treating, or problems with how the material was cast, forged, drawn, or otherwise fabricated.

Environmental reasons can be aggressive corrosive situations like salt water, extreme heat, and extreme cold, dissimilar metals.

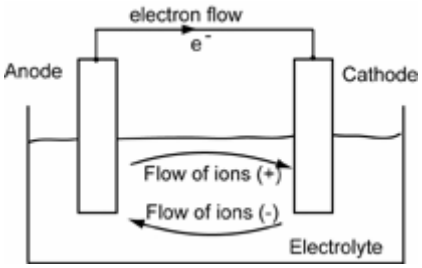
Intergrannular corrosion can be caused by metallurgical problems in the grain structure, by improper forging procedures, or heat treating, or exposure to chemical compounds such as ammonia in the environment.

Once cracking occurs the corrosion can spread throughout the material, possibly undetected to the eye until the failure occurs.

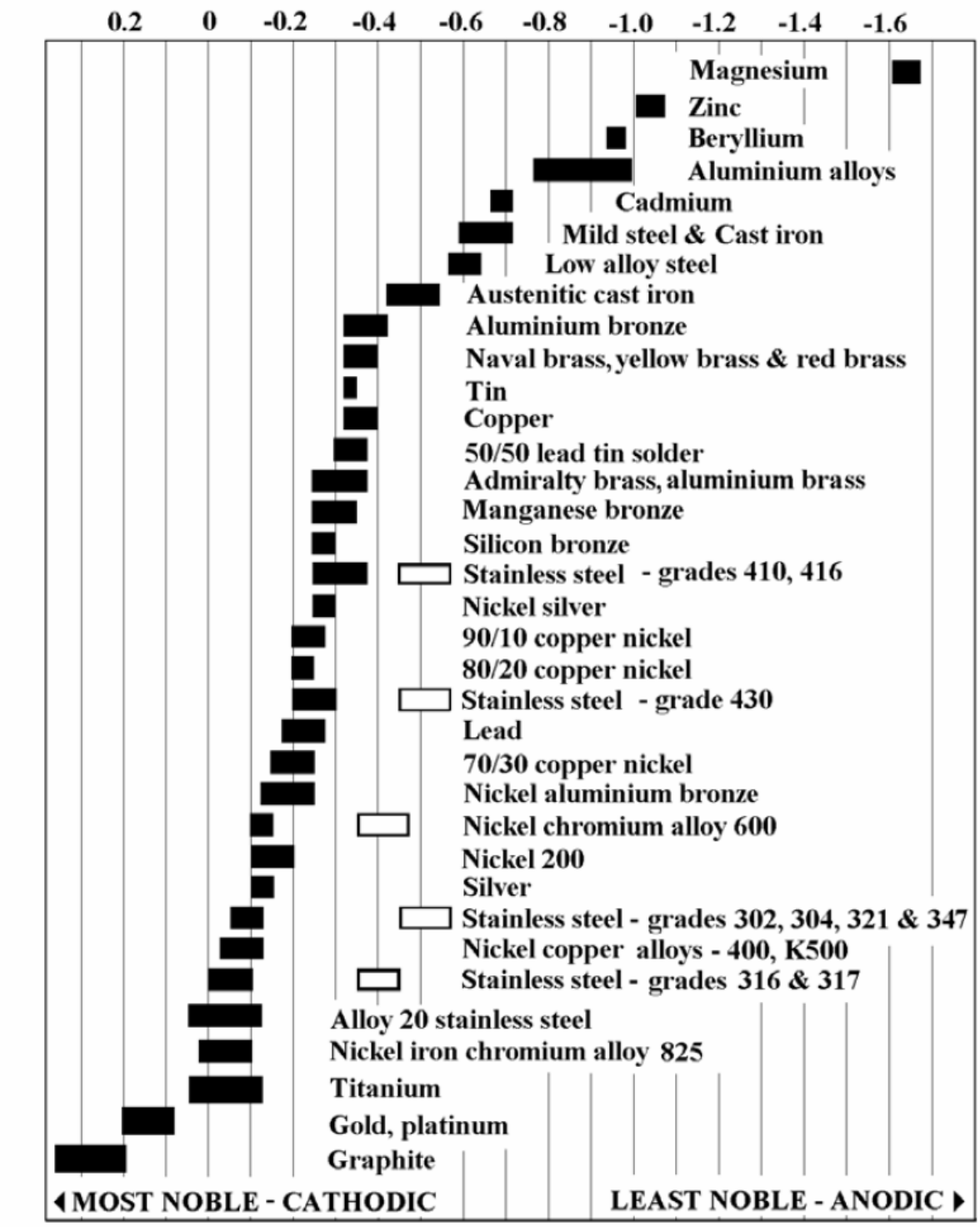
Prevention from vibration, loading and unloading stresses can help reduce this type of problem. Wherever possible seams should be avoided, and if not then coatings or platings can help. Detection of susceptibility to intergranullar corrosion by testing to ASTM A262 also can help prevent stress corrosion from occurring.

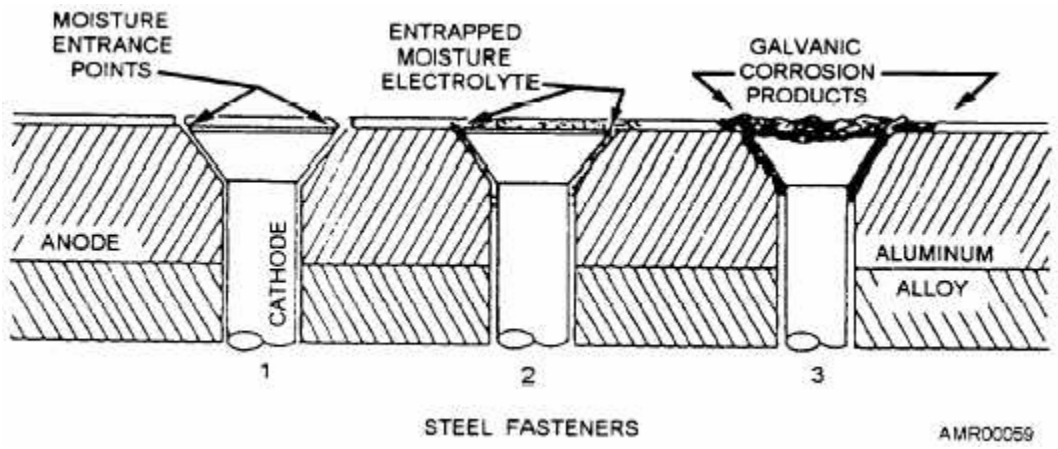
### Galvanic Corrosion:

A simple explanation for galvanic corrosion is an electrochemical process that causes a deterioration of metals by a very slow steady action. Part or all of the metal becomes transformed from the metallic state into ionic state, then turned into chemical compounds in the electrolyte.




The  scientific explanation is when two dissimilar conducting materials in electrical contact with each other are exposed to an*electrolyte* (water etc), a current, called the galvanic current, flows from one to the other. Natural electrolytes are salt water and fresh water. Salt water is more conductive because of the salt content, so galvanic corrosion happens faster. In fresh water the reaction is slower and is not wide spread across the metal affected. One material will be "*anodic*" the other "*cathodic*". Materials will have different galvanic properties. The more cathodic material will corrode less, the more anodic will corrode faster. See illustration. Thus if an aluminum part and a stainless part are fastened together, the aluminum part will corrode much faster than the stainless part. Generally stainless steel fairs better in a galvanic corrosion situation.


0.2
0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
Magnesium
Zinc
Beryllium
Aluminium alloys
Cadmium
Mild steel & Cast iron
Low alloy steel
Austenitic cast iron
Aluminium bronze
Naval brass, yellow brass & red brass
Tin
Copper
50/50 lead tin solder
Admiralty brass, aluminium brass
Manganese bronze
Silicon bronze
Stainless steel - grades 410, 416
Nickel silver
90/10 copper nickel
80/20 copper nickel
Stainless steel - grade 430
Lead
70/30 copper nickel
Nickel aluminium bronze
Nickel chromium alloy 600
Nickel 200
Silver
Stainless steel - grades 302, 304, 321 & 347
Nickel copper alloys - 400, K500
Stainless steel - grades 316 & 317
Alloy 20 stainless steel
Nickel iron chromium alloy 825
Titanium
Gold, platinum
Graphite
MOST NOBLE - CATHODIC
LEAST NOBLE - ANODIC


MOISTURE
ENTRANCE
POINTS
ENTRAPPED
MOISTURE
ELECTROLYTE
GALVANIC
CORROSION
PRODUCTS
ANODE
CATHODE
ALUMINUM
ALLOY
1
2
3
STEEL FASTENERS
AMR00059