Zygology

Galvanic Corrosion Chart

All dissimilar materials have the potential to react with each other when they are brought together in the presence of a catalyst. In most circumstances this reaction is so mild as to be of no importance, but when the wrong materials are used in combination and then exposed to an electrolyte such as water the effects can become much more noticeable. For applications where humidity is low then you can generally ignore galvanic corrosion. If on the other hand you are working on a project for use in damp conditions or outside then it is best to pay some regard to the possible effects of galvanic corrosion.
As a rule it is best to use metals which are as close together as possible in the table below. Doing this will help to eliminate any possibility of galvanic corrosion.
If you do have to mix materials then take a look at the galvanic compatibility section

Active (Anodic) Most Likely To Corrode
Magnesium
Magnesium alloys
Zinc (hot-dip, die cast, or plated)
Aluminium 1100, 3003, 3004, 5052, 6053
Tin (plated)
Lead
Steel 1010
Iron (cast)
Stainless steel 410 (active)
Copper (plated, cast, or wrought)
Nickel (plated)
Chromium (Plated)
Stainless steel 301,304,310 (active)
Stainless steel 430 (active)
Tungsten
Brass
Nickel-silver (18% Ni)
Stainless steel 316L (active)
Bronze 220
Copper 110

Red Brass
Stainless steel 347 (active)
Copper-nickel 715
Admiralty brass
Stainless steel 202 (active)
Bronze, Phosphor
Monel 400
Stainless steel 201 (active)
Stainless steel 321 (active)
Stainless steel 316 (active)
Stainless steel 309 (active)
Stainless steel 17-7PH (passive)
Silicone Bronze 655
Stainless steel 301,304,321 (passive)
Stainless steel 201,286 (passive)
Stainless steel 316L (passive)
Stainless steel 202 (passive)
Titanium

Noble (Cathodic) Least Likely To Corrode

Galvanic Compatibility

Often when design requires that dissimilar metals come in contact, the galvanic compatibility is managed by finishes and plating. The finishing and plating selected facilitate the dissimilar materials being in contact and protect the base materials from corrosion.

• For harsh environments, such as outdoors, high humidity, and salt environments fall into this category. Typically there should be not more than 0.15 V difference in the "Anodic Index". For example; silver - nickel would have a difference of 0.15V being acceptable.

• For normal environments, such as storage in warehouses or non-temperature and humidity controlled environments. Typically there should not be more than 0.25 V difference in the "Anodic Index".

• For controlled environments, such that are temperature and humidity controlled, 0.50 V can be tolerated. Caution should be maintained when deciding for this application as humidity and temperature do vary from regions.

Anodic Index	Index (Volts)
Silver, solid or plated; monel metal. High nickel-copper alloys	0.15
Nickel, solid or plated, titanium an s alloys, Monel	0.30
Copper, solid or plated; low brasses or bronzes; silver solder; German silvery high copper-nickel alloys; nickel-chromium alloys	0.35
Brass and bronzes	0.40
High brasses and bronzes	0.45
18% chromium type corrosion-resistant steels	0.50
Chromium plated; tin plated; 12% chromium type corrosion-resistant steels	0.60
Tin-plate; tin-lead solder	0.65
Lead, solid or plated; high lead alloys	0.70
Aluminum, wrought alloys of the 2000 Series	0.75
Iron, wrought, gray or malleable, plain carbon and low alloy steels	0.85
Aluminum, wrought alloys other than 2000 Series aluminum, cast alloys of the silicon type	0.90
Aluminum, cast alloys other than silicon type, cadmium, plated and chromate	0.95
Hot-dip-zinc plate; galvanized steel	1.20
Zinc, wrought; zinc-base die-casting alloys; zinc plated	1.25
Magnesium & magnesium-base alloys, cast or wrought	1.75

Please Note: Galvanic corrosion is a complex problem with many variables which are difficult to predict. The information above is provided for guidance only - and is only a short summary of the issues involved. Zygology Ltd can take no responsibility for application failure resulting from errors or omissions in the data provided.

Zygology Ltd
2 Barnes Wallis Court,
Wellington Road,
High Wycombe,
Buckinghamshire,
England,
UK
HP12 3PS

Callers from the UK:
Tel: 08458 121 220
Fax: 08458 121 221

Non UK callers:
Tel: +44 1494 437437
Fax: +44 1494 474785