ANACONDA Cable Lore

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CORROSION

The corrosion of metals is essentially the reverse of the recovery of metals from their ores. The reduction of aluminum oxide to metallic aluminum is a good example.

(a) Metal Refining

Aluminum Ore + Energy — — — — — — Aluminum Metal

(b) Corrosion

Aluminum Metal — — — — — — — — Aluminum Ore + Expenditure of Energy

Man expends much energy, money and technology to obtain metals in a relatively pure state. Metals do not want to exist in a pure state and will take the path of least resistance to accomplish this objective. The latter part of this statement can be considered as corrosion. This is why only a few metals are found in a metallic state and why these metals exhibit good corrosion resistance. Gold, silver, platinum and copper are good examples.

To escape the pure state, metals will react with practically any chemical environment. The length of time required for substantial or complete corrosion to occur depends on several factors:

(1) The chemical activity of the metal involved.
(2) The type, concentration and temperature of the chemical environment.
(3) Proximity to other metals.

The general problem of corrosion is extremely complex and many areas are not completely understood even by corrosion engineers with expertise in this field.

Some appreciation for the mechanisms involved in corrosion of metals can be gained by reviewing the electrochemistry involved in a simple battery or plating bath. A battery, for example, can be as fundamental as taking a beaker, filling it with chemical solution (electrolyte) and suspending a strip of copper on one side and a strip of iron on the other side. A simple experiment and observation will reveal two types of phenomena are occurring.

(1) A voltmeter connected between the two plates will show that a voltage can be read.
(2) Metal will leave one plate and be deposited on the other plate.

These phenomena are a mixed blessing:

(1) With proper selection of materials and controls they form the basis for the manufacture of batteries and the electroplating industry.
(2) On the other hand they are the basic mechanism for galvanic corrosion of metals.

(continued)

The vulnerability of exposed metallic components in a buried cable can be easily visualized with a little imagination. Take for example a buried type URD cable. The concentric wires are exposed to a chemical warehouse, the contents of which will vary from one geographical location to another. Some possibilities are:

(1) Acid soils
(2) Alkaline soils
(3) Chemical solutions (water plus dissolved chemicals)
(4) Industrial waste and fills

In this type of environment the concentric wires become one plate, a buried pipeline a second plate and with a wet soil in between - an ideal set-up for electrochemical reaction resulting in corrosion of the concentric wires.

Some costly and complex schemes are available to minimize corrosion. The simplest and most feasible with cables is to provide a covering or jacket so that metal components are not exposed to detrimental chemical environments. This, too, adds cost.

Research and development is being directed toward simpler and less costly solutions. New cable concepts are on the horizon.

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