GALVANIZATION FOR CORROSION INHIBITION

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Deterioration of metal surfaces in aggressive environment is defined as metal corrosion. The aggressive environment may be a liquid or a gas. Also, corrosion is a chemical or an electrochemical oxidation process, in which metal transfers electrons to the aggressive environment as follows.

$$M \longrightarrow M^{n+} + ne$$

Corrosion causes structural damage and it leads to many environmental problems. Therefore prevention of corrosion process is very important. Among corrosion prevention methods, galvanization is the most widely used technique. The process of applying a protective zinc coating to steel or iron is known as galvanization. There are three major processes for applying zinc to iron and steel, and those are hot dip-galvanizing, electro galvanizing and zinc spraying. Among these processes, most products are coated using hot-dip process.

Figure 1: Galvanized steel pipes

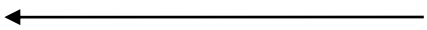
Figure 2: Galvanized roofing sheets

The term is derived via French from the name of Italian scientist Luigi Galvani. Originally, galvanization was referred to the administration of electric shocks. In the 19th century it was also termed as Faradism. The term galvanization has largely associated with zinc coating, to the exclusive of other metals. Galvanic paint, a precursor to hot-dip galvanization, was patented by Stanislas Sorel, of Paris, Franch in December, 1837. The earliest known example for galvanization of iron is found in 17th century which is the Indian armor in the Royal Armouries meuseum collection [1].

When choosing a corrosion prevention method, it must be an environmental friendly and a low cost method. Galvanization protects steel by acting as barrier to the moisture. Moisture acts as the electrolyte to metal corrosion process. This is a primary protection method for galvanized steel. Freshly exposed zinc form a thin zinc oxide layer. That zinc oxide forms zinc hydroxide when contact with water. Finally it becomes zinc carbonate by reacting with atmosphere carbon dioxide. It corrosion resistance is 7 to 10 times higher than that of iron.

The most important way of corrosion prevention of galvanization process is galvanical protection. It is also known as the cathodically protection [1]. Since zinc is more active than steel in the galvanic series, this process occurs. Variation of activity of some metals is shown below.

Mg > Zn > Al > Cd > Fe > Pb > Sn > Cu > Au



Increase the oxidation ability

Any one of these metals and alloys will theoretically corrode while protecting any other that is lower in the series as long as both form part of an electrical circuit and an electrolyte solution is present [2]. In practice, this means that a zinc coating will not be undercut by rusting steel, because the steel cannot corrode adjacent to the zinc coating. Coating thickness and conditions of exposure decide the service life of galvanized steel.

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References

1. Dallin, G.W., Continuous hot-dip galvanizing–process and products, 2012.
2. http://www.hotdipgalvanizing.com/hot_dip_galvanizing_process/index.html. (accessed on 25.02.2015)