INTRODUCTION

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Aluminium and aluminium alloys lend themselves to many industrial applications because of their combinations of lightness with strength, their excellent conducting capacity for both electricity and heat, their good formability and low cost and for their corrosion resistance. They are now among the most important non-ferrous alloys that have a remarkable economic importance.

From the point of view of corrosion susceptibility and resistance, aluminium represents a particular case between metals. While it is among the most active metals in the electrochemical series (with a standard potential(-1.6 volt vs. NHE), it generally developes a protective film or coating. This contradicting behaviour makes aluminium a metal of great interest. Such a protecting film could be artificially produced by a process known as anodization. However aluminium is highly resistance to most atmospheres and to great variety of chemical compounds.

Pourbiax potential-pH diagram of aluminium-H_2O system summarized the conditions in which

aluminium may follow one of the following paths:

$$Al \longrightarrow Al^{3+} + 3e \qquad \text{at low pH}$$

$$Al + 2\,OH^- \longrightarrow AlO_2^- + e \qquad \text{at high pH}$$

$$Al + H_2O \longrightarrow Al_2O_3 \cdot 3H_2O \qquad \text{at neutral pH}$$

At low, high pH's, the corrosion product is soluble cations or anions, respectively. This indictates general corrosion with high rates. At neutral pH, passivity due to the formation of solid product is observed.

As any amphoteric metal, the rate of corrosion of Al has minimum values in neutral solutions. Al^{3+} with hydrogen evolution are the main product in acidic solutions. Aluminate is the soluble product formed in the alkaline solutions.

1- GENERAL CORROSION :

It is generally true that the higher the degree of purity of aluminium, the greater is its corrosion resistance. The relative corrosion rate of 99.97% aluminium in HCl and KOH at 20°C was found to be thousand fold greater than that of 99.98% aluminium. Thus, minor impurities increase the rate of general corrosion.

Certain elements such as magnesium, manganese, and zinc could be alloyed in amounts up to 1% with the refined (AA-1099) aluminium without affecting the corrosion resistance of the pure metal in many environments.

The influence of a specific impurity or an alloying-element on the corrosion resistance of an aluminium alloy depends on the nature of impurities, on the amount present, on the metallurgical history of the alloy and on the environment in which it exists or to which it is exposed. Thus, a given alloying element does not always have the same effect. However, the effect of elements which form intermetallic compounds with aluminium depends on whether they are present in solid solution or as a second phase.

Copper, as an alloying element, reduces the corrosion resistance[1] of aluminium more than any other alloying element. It leads to a higher rate of general corrosion, a greater incidence of pitting, and when added in small amount (for example 0.15 %) a lower rate of pitting penetration is observed[1]. The influence of copper is greatly dependent on its concentration, form, and its distribution in the alloy microstructure.

Magnesium tends to have a beneficial influence and Al-Mg aloys have a good corrosion resistance. Magnesium increases the resistance of the aluminium alloys to alkaline solutions. In general, Al-Mg alloys offer the best combination of strength and corrosion resistance, and are prefered for structural purpose in corrosive environments.