INTRODUCTION

Corrosion is a natural process, which converts a refined metal to a more stable form, such as its oxide, hydroxide, or sulfide. It is the gradual destruction of materials (usually metals) by chemical and/or electrochemical reaction with their environment. Corrosion engineering is the field dedicated to controlling and stopping corrosion. Corrosion can be defined as the degradation of a material dueto a reaction with its environment.

Degradation implies deterioration of physical properties of the material. This can be a weakening of the material due to a loss of cross-sectional area, it can be the shattering of a metal due to hydrogen embrittlement, or it can be the cracking of a polymer due to sunlight exposure.

Materials can be metals, polymers (plastics, rubbers, etc.), ceramics (concrete, brick, etc.) or composites-mechanical mixtures of two or more materials with different properties. Because metals are the most used type of structural materials most of this web site will be devoted to the corrosion of metals.

Corrosion Engineering is the specialist discipline of applying scientific knowledge, natural laws and physical resources in order to design and implement materials, structures, devices, systems and procedures to manage the natural phenomenon known as corrosion. Generally related to Metallurgy, Corrosion Engineering also relates to non-metallics including ceramics. Corrosion Engineers often manage other not-strictly-corrosion processes including (but not restricted to) cracking, brittle fracture, crazing, fretting, erosion and more.

THE CONSEQUENCES OF CORROSION / CORROSION DAMAGE

The consequences of corrosion are many and varied and the effects of these on the safe, reliable and efficient operation of equipment or structures are often more serious than the simple loss of a mass of metal. Failures of various kinds and the need for expensive replacements may occur even though the amount of metal destroyed is quite small. Some of the major harmful effects of corrosion can be summarised as follows:

1. Reduction of metal thickness leading to loss of mechanical strength and structural failure or breakdown. When the metal is lost in localised zones so as to give a cracklike structure, very considerable weakening may result from quite a small amount of metal loss.

2. Hazards or injuries to people arising from structural failure or breakdown (e.g. bridges, cars, aircraft).

3. Loss of time in availability of profile-making industrial equipment.

4. Reduced value of goods due to deterioration of appearance.

5. Contamination of fluids in vessels and pipes (e.g. beer goes cloudy when small quantities of heavy metals are released by corrosion).

6. Perforation of vessels and pipes allowing escape of their contents and possible harm to the surroundings. For example a leaky domestic radiator can cause expensive damage to carpets and decorations, while corrosive sea water may enter the boilers of a power station if the condenser tubes perforate.

7. Loss of technically important surface properties of a metallic component. These could include frictional and bearing properties, ease of fluid flow over a pipe surface, electrical conductivity of contacts, surface reflectivity or heat transfer across a surface.

8. Mechanical damage to valves, pumps, etc, or blockage of pipes by solid corrosion products.

9. Added complexity and expense of equipment which needs to be designed to withstand a certain amount of corrosion, and to allow corroded components to be conveniently replaced.

CORROSION RATE EXPRESSION

Corrosion rates have been expressed in a variety of ways such as percent weightloss, milligrams per square centimeter per day and grams per square inch per hour.These do not express corrosion resistance interms of penetration. From an engineering point of view, the rate of penetration or the thinning of a structural piece can be used to predict the life of a given component.

The expression mils per year (mpy) is the most desirable way of expressingcorrosion rates.

Mpy = 534 W / DAT

Where

W is the weight loss in mg

D is the density of the Specimen in g/cm^3 A is

the area of the specimen in Sq.In

T is the exposure time in Hr

CLASSIFICATION OF CORROSION

Corrosion can be classified in different ways, such as

- Chemical and electrochemical
- High temperature and low temperature
- Wet corrosion and dry corrosion.

Dry corrosion occurs in the absence of aqueous environment, usually in thepresence of gases and vapours, mainly at high temperatures.

There are different forms of corrosion such as

1. Galvanic corrosion
2. Crevice corrosion
3. Pitting
4. Intergranular corrosion
5. Erosion corrosion
6. Stress corrosion