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Corrosion Engineering: Positive Attitude Towards Corrosion

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ABSTRACT:

Corrosion in simple terms may define as the destructive attack of a specified substance by reaction with its environment. The main aim of the review is to explore the possibilities of corrosion control which can only be achieved by recognizing and understanding the corrosion mechanism, by making the use of corrosion free substances and specified phenomena by using protective systems.These above mentioned all parameters can only be summoned into a one topic that is corrosion engineering. The review posses all the aspects, the currently adapted parameters for corrosion engineering. Positive attitude towards corrosion is motivated to look over a problem with a positive attitude, so as it can be swept out in an easy way.

Keywords: Corrosion Engineering, Corrosion, Federal Highway Administration, N.A.C.E (National Association of Corrosion Engineering), E.F.C (European Federation of Corrosion), Corrosion Failures, Corrosion Inhibitors, Corrosion conscious designs, Corrosion Inspection, Corrosion Inhibitors.

Introduction:

Corrosion may be defined as an insidious problem with wide ranging impact. The serious consequences of corrosion process have become a problem of worldwide significance. In addition to day to day problems associated with corrosion that is in a form of degradation, plant shutdowns, and waste of valuable resources, loss or unhygienic products and downward movement of maintenance of cost [1]. The multidisciplinary aspect of corrosion problems combined with the distributed responsibilities associated with such problems only increases the complexity of the subject. The only may to cope up with the harshening problems of corrosion is an adaptation of the parameters and aspects of corrosion engineering. Major corporations, industries and government agencies have established groups and committees to have or to look after the corrosion engineering issues [2].

The major problem of growth is the cost of corrosion. A 2001 study by the Federal Highway Administration estimated that (direct) corrosion costs the US $ 276 Billion annually (3.1.1 of GDP) some industries make the use of decision designs or we may say lessons learned, implemented through a required list of materials/processes/details. The challenge for making decision designs is possibly the affordable considerations mitigation measures.

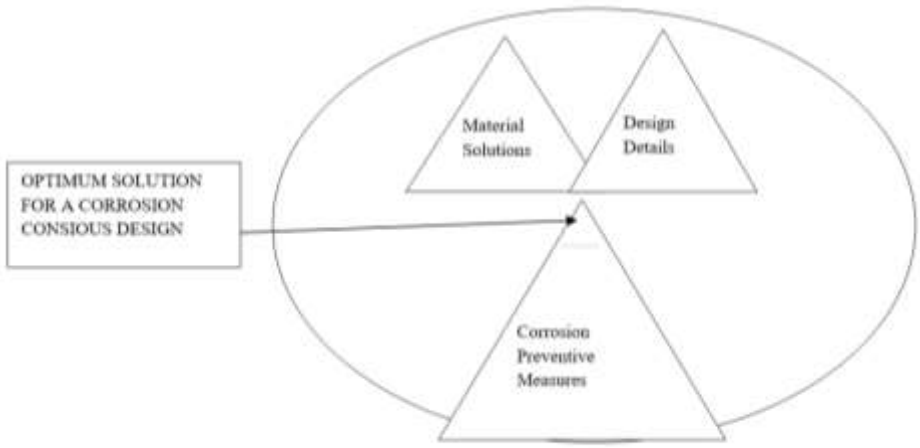

Figure 1: An example of designs decisions.

Significance of Corrosion Engineering:

Control of corrosion in engineering designs basically termed as corrosion engineering. The significant approach towards corrosion deals with as it is considered as a specialist discipline of applying scientific processes, natural phenomena and physical needs in order to design and implement materials, processes to manage natural phenomena known as corrosion[3]. Generally when this concept related to metallurgy but somehow it also deals with the non metallic aspects including ceramics also. Significantly corrosion engineering groups have formed around the motive in order to slow and manage the effects of corrosive habitat. Examples are:

- NACE (National Association of Corrosion engineering).
- EFC (European Federation of Corrosion)

Types of Corrosion:

Basically corrosion deals with three major classifications:-

1. Aqueous Corrosion :-

One of the key factors in any classification of corrosion known to be environment. In our day to day life water being considered as a most important used for a wide variety of purposes, since as and when steels and iron-based alloys are metallic materials most commonly exposed to water. Aqueous corrosion will lead to a discussion with a special focus on reaction of Iron (Fe) with water [4].

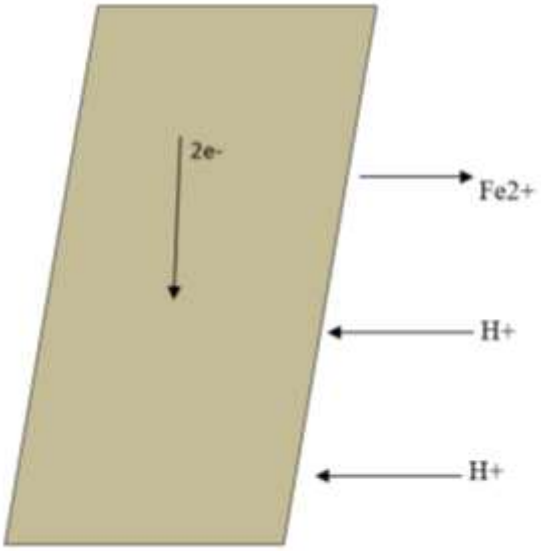

Figure 2: Simple model describing the electro-chemical nature of corrosion process:

The above diagram illustrates that metal ions go into solution in anodic areas. Thermodynamic principles explains of the situation arises by corrosion in the aspect of stability of chemical species and reaction associated with corrosion processes [5].

2. Atmospheric Corrosion :

Atmospheric corrosion deals with the corrosion of materials exposed to air & its pollutants, rather than immersed in liquid. It has been investigated that atmospheric corrosion accounts for more failures in terms of cost and tonnage than any other factor [6].

Table 1: List of ISO standards related to Atmospheric corrosion:

ISO STANDARD	TITLE
ISO 9223	Classification of corrosivity of atmosphere
ISO 9224	Guiding values for corrosivity categories of atmosphere
ISO 9225	Agressivity of atmospheric corrosion
ISO 9226	Corrosivity of atmosphere

3. High temperature Corrosion :

Corrosion Failures:

Performance of a failure Analysis is not an easy or straightforward task. Early estimation of corrosion is critical. To avoid all of these pitfalls, step by step or we can say systematic procedures and being observed to investigate the failure analysis [7]. Corrosion failures can be analyzed by investigating the Mechanism, forms and modes of corrosion failure. The researcher Dillon considered Fontanas basic forms of corrosion & divided them into 3 categories:-

1) Group 1: Readily identified by ordinary visual examination.
2) Group 2: May require supplementary means of examination.
3) Group 3: Verification is usually required by microscopy.

Maintenance of Corrosion through Inspection and Monitoring:-

Requirement of appropriate level of Monitoring will vary greatly with severity of the operating environment as well as criticisms of engineering systems. Corrosion inspection and monitoring are initially being used for analyzing the system condition as well as how efficiently corrosion control and maintenance of programs are performing corrosion monitoring embraces a host of techniques from simple exposure of coupons to smartly structured computerized sensing systems[8]. The dividing line between inspection and monitoring is that, inspection resembles to the short term measurements taken in accordance with maintenance and inspection schedules. Monitoring describes the measurement of corrosion damage over a long time period.

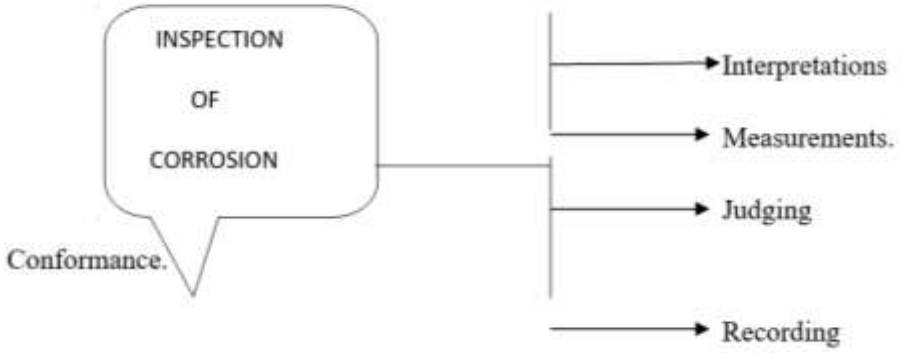

Figure 3: Series of action for inspection:

Protective Coatings:

Protective coatings are being considered the most widely used for corrosion control. They are considered as specified protection under a broad range of corrosive conditions, which extends to atmospheric exposure to most demanding chemical processing conditions [9]. In a major way protective coatings are of following types:

a) Metallic coatings (Aluminum, nickel, zinc).
b) Electroplating
c) Cladding (for improving corrosion resistance)
d) Thermal spraying
e) Physical vapor deposition.

Corrosion Inhibitors:

The major motive of corrosion inhibitors is to decrease the rate of corrosion. Numerous scientific studies showed their devotion to the subject of corrosion inhibitors. Corrosion inhibitors are a specified chemical substance, when added in small concentration to the environment, effectively decreases the corrosion rate [10].

They are being classified into:-

1) Inorganic Inhibitors
2) Organic Anionic: example is Sodium sulfonetes, mercapto benzotriazole (MBT) etc.

3) Organic Cationic.

Conclusion:

Concluding the review with a future perspective in mind that corrosion engineering would surely help to create a book to solve corrosion issues with a positive attitude. Currently, various researches are taking place to improve the engineering aspects/parameters of corrosion which further lead to the best results to cope up with the natural phenomena called as corrosion.

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