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A STUDY ON CATHODIC PROTECTION SYSTEM FOR PIPELINE CORROSION

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Abstract

The term corrosion refers to the weakening of metals by biochemical interaction surrounded with its environment. Due to corrosion, dropping of metal wideness clues to loss of mechanical power and operational disaster and it creates harmful effects. Corrosion formation is a natural phenomenon in which involvement of reversion action from metal to compound state will take place. So it develops a natural patent that the formation of corrosion might not be fully prohibited, in its place artificially it can be measured to a greater range depends on the metal surface. During the manufacturing process of metals form its raw materials, their stable ores such as oxides, sulphides and carbonates, etc. are being take out from the raw materials by disbursing massive amount of energy. These metals having a normal impulse to move back towards their native state. Virtually all corrosion reactions in metal surfaces are electrochemical in nature, the term corrosion is also referred as "Rusting" specifically for iron and iron base alloys. Rusting formation of steel such as tarnishing copper and silver is reddish brown in color and formation of white color on zinc product are different forms of corrosion occurred in metal surfaces. Our preliminary research study focuses on "Impressed Current Cathodic Protection System". In an impressed current system, current is being fascinated from an external source - DC (direct current)using expendable anodes. In practice rectified alternating current is forced to a system making use of metals with low deterioration as anode materials.

Keywords : Corrosion, Cathodic protection, Impressed Current, Direct Current.

Introduction

Significance of Corrosion Treatment

The consequences of corrosion affect in two factors. The main factor is depending on their economic importance resulting in the form of failure of pipelines, storage tanks and various machine components made up of metals. Another factor is maintenance of metal resources whose availability is limited in conservation. Disasters of such kinds and the essential for alternates may occur in major expense although the quantity of metal demolished is fairly minor. Corrosion refers to the weakening of metals by biochemical interaction surrounded with its environment. Corrosion formation is a natural phenomenon in which involvement of reversion action from metal to compound state will take place. During the manufacturing process of metals form its raw materials, metals from their stable ores are being extracted from the raw materials by expending enormous amount of energy. These metals having a normal impulse to move back towards their native state.

Practically corrosion reactions in metal surfaces are electrochemical in nature, the term corrosion is also referred as "Rusting" specifically for iron and iron base alloys. Corrosion is formed due to critical attack of metal surface by electrochemical reaction with its atmosphere. Rusting formation of steel such as tarnishing copper and silver is Reddish brown in color and formation of white color on zinc product are different forms of corrosion occurred in metal surfaces.

Review of Literature

Exploration on How Corrosion Occurs

Metals are found from their naturally occurring iron ores by undergoing various chemical reactions and it can be observed and it will lose their energy by deteriorating to mixtures similar to their original conditions. Generally corrosion retorts remain electrochemical in nature. During this state at the anodic spots on the surface, the iron spirits into solution in the name of ferrous ions; this will constitute the anodic reaction on the surface of the metal. As iron atoms present in the metal undertake oxidation to ions they discharge electrons whose negative charge would rapidly construct in the metal surface and prevents additional anodic reaction.

Bacteriological Corrosion

Anaerobic sulphate reducing bacteria is responsible for this type of corrosion. They thrive in neutral and poorly aerated medium usually clay, and the products generated during their life process serve to depolarize the corrosion cells that otherwise might not progress to the point of significant damage to metal. Another kind of bacteria, sulphur oxidizing bacteria generate acids that are corrosive.

Differential Exposed Surface Area

This is a case of small anode and large cathode, corrosion at the anode will progress rapidly. Corrosion cells operating in pipelines, Examples are: Rivets used to fasten structural members of steel, Bolts and nuts in pipelines, Small pipes electrically connected to larger pipes.

Dissimilar Soils

Difference in composition of the soil can create corrosion cells. The difference in soil conditions may cause potential difference on pipelines resulting corrosion due to dissimilar soil condition. The dissimilar soil corrosion arise between the presence of low resistivity (anodic) – high resistivity (cathodic), wet soil (anodic) – dry soil, Clay – silt, Dense soil loose soil, Alkaline soil neutral or acid soil.

Pitting Corrosion

Pitting corrosion takes place at places of coating defects caused during manufacturing, handling on construction. In all modes of corrosion, pitting is a dangerous form of corrosion involving faster penetration through metal.

Differential Ph

When the pipeline passes through areas which are contaminated by the spillage of caustic chemical the portion which is exposed to low pH act as anode compared to high pH.

Connection of New and Old Pipes: Direct connection of new pipeline and old pipelines are connected, the new pipe becomes anodic to older pipe and corrodes.

Crevice Corrosion: Small stagnant entrapments of materials behave like dissimilar electrolytes with the surrounding environments. This type of corrosion can be seen at overlaps of metals crevices under bolt and rivet heads.

Corrosion Control Methods

The corrosion control measures are broadly classified into 4 categories

1. Modification of metals.
2. Modification of environments.
3. Change of metal/environment potential.
4. Use of nonmetallic materials.

Design Improvement

The deterrence of corrosion must initiate at the design phase, andbenefit should be promised of the range of shielding coatings and corrosion resistant resources available. If the metal has to be sheltered make facility in the design for applying metallic, non-metallic coatings or applying anodic or cathodic shield. Avoid geometrical formations that assist corrosive circumstances such as

1. Features that trap dust water and moisture.
2. Crevices and situation .
3. Design that lead to erosion-corrosion or.
4. cavitation damage.

Change of Metals

The corrosion resistance of metals is greatly improved by

1. change of composition.
2. change of structure.
3. Elimination of tensile stresses.

Conclusion

This study provides a report on the research done on Impressed Current Cathodic Protection System.The direct power source may be any one of the following; Rectifier, Thermoelectric generators, Battery, Generator driven by wind or fluid turbine, Energy accumulated from solar cells.

Advantages of impressed current cathodic protection; Availability of wide range of voltage output and current output, ampere current can be impressed with sgb (single ground bed), Larger areas can be protected with single installation, Can be used in highly resistive environments, Uncoated and ailing coated structures can be effectuallyshielded, Voltage and current output can be regulated.

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