Causes and detection of corrosion

Business, Management

There is type of corrosion caused by this corrosion tragedy, namely Electrochemical Corrosion. For the Electrochemical Corrosion, it is the combination of two electrodes, metal and electrolyte, which constitute a corrosive primary battery. For example, iron and oxygen, because the electrode potential of iron is always lower than the electrode potential of oxygen, so iron is the negative electrode and is corroded. It is characterized by the formation of many small drums of different diameters on the surface where oxygen corrosion occurs, and the secondary layer is a black powdery ulcer corrosion pit. In this case, the methane pipeline is present in the humid air caused by seawater for a long time. In the humid air, the surface of the steel adsorbs a thin film of water containing a small amount of hydrogen ions and hydroxide. The ions, which also dissolve oxygen and other gases, form an electrolyte solution on the surface of the steel. It forms a myriad of tiny primary cells with iron and a small amount of carbon in the steel. In these primary batteries, iron is the negative electrode and carbon is the positive electrode. Iron loses electrons and is oxidized, which is the main cause of corrosion of steel pipes after electrochemical corrosion.

Causes of corrosion

As we can see in the picture, Drilling platforms built on the surface of the sea have long been in humid air. A large part of the cause of corrosion is environmental factors. The salt content of seawater, temperature, dissolved oxygen, pH, flow rate and waves, sea creatures, etc. are all factors that may affect seawater corrosion. Due to the presence of a thin film of electrolyte saturated with oxygen on the metal surface, atmospheric corrosion is corroded by a preferential oxygen depolarization process. On the other hand,

it is easy to cause proper conditions for anode passivation under a thin layer of electrolyte, and solid corrosion products are often deposited in layers on the metal surface, thus providing some protection. The marine atmosphere refers to an atmospheric environment containing a large amount of salt above sea level due to evaporation of seawater. This atmosphere has a high salt spray content and has a strong corrosive effect on metals. Unlike steel corrosion immersed in seawater, atmospheric corrosion in the ocean is caused by the formation of a thin film of water on the surface of the object, as is the atmospheric corrosion in other environments. The relative humidity in the ocean atmosphere is large, and because the seawater droplets contain sodium chloride particles, the relative humidity of the air is higher than its critical value for the marine steel structure. Therefore, a corrosive water film is easily formed on the surface of steel in the ocean atmosphere. The effect of thin water film on steel is atmospheric corrosion. It is characterized by the fact that oxygen is particularly easy to reach the surface of steel. The corrosion rate of steel is controlled by the oxygen polarization process. The impurities contained in the air have a great influence on the atmospheric corrosion. The sea atmosphere is rich in a large amount of sea salt particles. These salt particles are dissolved in the water film on the surface of the steel, making this water film a highly corrosive electrolyte, which accelerates the corrosion progressed.

In contrast, human factors have a relatively small impact on corrosion. It is difficult to change the environmental factors of seawater atmospheric corrosion in pipelines, because the entire drilling platform already exists in the ocean, which makes it difficult to control the environmental factors of

seawater particles corroding the pipeline. People can only slow down the corrosion of the pipeline by regularly inspecting the pipeline and maintaining and maintaining the pipeline in a timely manner. In this tragedy, the lack of regular maintenance and maintenance of the pipeline has caused the corrosion of the gas pipeline to be unchecked. Eventually, the pipeline is corroded and causes tragedy, which is a human error factor in pipeline corrosion.

Mechanism for the occurrence of corrosion

The so-called marine environment refers to any physical state ranging from the ocean atmosphere to the seabed mud, such as temperature, wind speed, sunshine, oxygen content, salinity, pH value and flow rate, etc., which can generally be divided into several different properties. There are types such as marine atmosphere, wave splash zone, water level change zone, full immersion zone and muddy zone. The steel structure has electrochemical corrosion in the five regions of the marine environment. This electrochemical corrosion process is the same as that of the electrolyte battery. The three elements that make up this reaction are the anode, the cathode and the electrolyte. Steel is a mixture of iron and cementite. The potential of iron is low, the potential of cementite is high, and the two elements with different potentials under the action of electrolyte solution constitute iron as anode and carburizing. The micro battery network, which is a cathode, generates current.

In the anode region, ferrite is precipitated due to the action of polar water molecules, and the free iron ions enter the solution, which is the active

dissolution process of the metal. In the cathode region, electrons in the anode region flow to the cathode through the steel body due to the potential difference, and are absorbed by some substances in the solution. Under normal circumstances, that is, when the pH of the solution is greater than 4, it represents the reduction of oxygen; when the pH of the solution is less than 4, it represents the precipitation of hydrogen: the iron ion of the anode product is combined with the hydroxide ion of the cathode product. A preliminary corrosion product, ferrous hydroxide, is formed and precipitated, and the ferrous hydroxide is further oxidized by oxygen in the solution to be converted into iron hydroxide. The solubility of iron hydroxide is small, and it is wrapped in a loose film on the surface of steel. It has a certain protective effect, but its impermeability is weak and its properties are unstable. When there is sufficient oxygen supply in the solution, the corrosion process has been Carry on until the steel becomes rust.

Detection of corrosion

Using the principle of electromagnetic induction, non-destructive testing of conductive materials and their work pieces is performed by detecting changes in induced eddy currents in the work piece being inspected, or non-destructive testing methods for detecting defects are called eddy current testing.

Eddy current testing is one of the primary methods of corrosion detection in electrically conductive materials. It is one of the main means to control the quality of various metal materials and a few non-metallic conductive materials (such as graphite) and their products. Compared to other non-

destructive tests, eddy current testing makes it easier to automate inspections, especially for tubes, rods and wires. The higher the eddy current rate of the resulting material, the higher the corrosion detection rate.

When the conductor is in a changing magnetic field or the magnetic field is cut relative to the magnetic field motion, the current is induced inside by the law of electromagnetic induction. These currents are characterized by a self-contained closed loop inside the conductor that flows in a spiral, hence the name eddy current.

When the detecting coil carrying the alternating current is close to the conductive test piece (corresponding to the secondary coil), it is known from the electromagnetic induction theory that the induced magnetic field associated with the eddy current is superimposed with the original magnetic field, so that the complex impedance of the detecting coil changes. The magnitude, phase, flow pattern and associated magnetic field of the induced eddy current in the conducting body are affected by the physical and manufacturing process properties of the electrical conductor. Therefore, by measuring the change in the impedance of the detecting coil, it is possible to non-destructively determine the physical or process performance of the test piece and whether or not there is a defect, which is the basic principle of eddy current testing.

Within a few months after the oil spill, high concentrations of methane in the seawater were swallowed up by the rapidly breeding deep-sea methanogens, and methane quickly returned to normal. The US Coast Guard and Marine Energy Administration’s investigation report recommended the development

of a standardized procedure for testing the operational safety of the rig; improving the safety design of the rig to prevent flammable gases from entering the control room; and strengthening the explosion-proof valve group. The report also recommended that the government strengthen supervision and require operators to provide complete oil well control reports and conduct surprise inspections on deepwater drilling platforms. BP has built a four-storey giant “ golden bell” that hopes to drop to the bottom of the 1, 500-meter sea, cover the oil spill, keep the crude oil in the golden bell, and then pump it back to the sea. The tanker, but the temperature of the deep sea water is too low, and a large amount of ice crystals accumulate inside the golden bell jar, which cannot be operated normally in the middle. This plan has failed. BP is asked by the US government to set up a $20 billion fund to deal with the accident.