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SYNTHESIS OF ANTI-CORROSION COATINGS AND THEIR PROPERTIES

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ANNOTATION

Today, the creation of inhibitors and anti-corrosion coatings used to prevent and prevent corrosion of metals in various sectors of the economy of industrialized countries is one of the most pressing issues. In the developed countries of the chemical and petrochemical industries of the world, the damage caused by metal corrosion is 30% of the annual amount of metals produced, so the creation and use of anti-corrosion inhibitors and anti-corrosion coatings is important.

Keywords: metal corrosion, various sectors of the economy, chemical and petrochemical industry, metal structures, methods of corrosion protection, corrosion environment.

INTRODUCTION

Significant losses as a result of corrosion damage to metal products require the development of cost-effective corrosion protection methods. Due to the fact that the service life of metal structures in the natural environment is very short, their service life is widely used in the following ways:

1) Protection of the device surface from external aggressive environments by means of coatings;
2) Use of corrosion-resistant materials;
3) Exposure to the environment in order to reduce its aggression.
4) Application of methods of electrochemical protection of underground metal structures;

The most common methods of corrosion protection are to obtain corrosion-resistant surface coatings on the surface of products. The coating of metal surfaces with substances that are chemically inert to the metal and the environment and have high dielectric properties is a passive method, which includes the use of various mastic, primers, linings, plastics, composite polymeric materials, varnishes, enamels. enters. These materials are applied to the surface in a liquid state, and after drying, the solid metal surface has a sufficient strength and good adhesion (adhesive) protective coating (film). These methods also include covering the metal surface with thin adhesive coatings and methods of laying special underground devices, such as laying pipes in special channels (collectors).

There are ways to treat products with special alloys to obtain insoluble metal salts on their surface, such as the formation of insoluble phosphates on the surface of steel products or the formation of aluminum oxide on the surface of aluminum products. In this case, the coating of the surface of metal products with passive solutions is based on the transition of the surface from the active to the passive state. Methods of coating the surface of metal products with other metals are widely used in practice. The surface of details made of steel and alloys is coated with metals such as zinc, lead, copper, chrome. These coatings are divided into anode and cathode types depending on the process of application.

Corrosion inhibitors are surfactants that, even in small amounts, slow down the processes of corrosion and changes in the mechanical properties of metals and alloys when added to aggressive environments. The use of corrosion inhibitors in the oil and gas industry is due to the fact that the equipment and devices used in the industry are made of structural carbon steels and operate in an "oil-gas-water" aggressive corrosion environment. Corrosion inhibitors can be used alone or in combination with other protection methods.

Currently, in the oil and gas industry, high-molecular organic compounds: aliphatic and aromatic compounds associated with nitrogen, sulfur and oxygen are used as inhibitors.

As corrosion is a physicochemical process, the environment is directly related to corrosion activity. When metal pipes are buried in the ground, they can be exposed to soils of different composition and stray currents.

The applied technological measures (insulating coatings, etc.) are damaged over time for various reasons, and as a result of this damage corrosion processes occur.

Underground pipes, cartridges used under railways and highways, underground metal containers, etc. are protected from soil corrosion by treads. In tread protection, the corrosive elements are extinguished by a current of galvanic elements forming an electrochemically active metal electrode mounted on the ground where the pipe is located, ie the pipe is protected from corrosion as a result of the tread electrode melting as an anode. A metal tread is attached to the steel pipe, resulting in a galvanic element "pipe-tread". The pipe acts as a cathode, the protector acts as an anode, the ground acts as an electrolyte, the cathode, ie the pipe is protected, the anode-protector is destroyed.

Research on methods of corrosion protection is carried out mainly in the following areas:

- Impact on metal;
- Environmental impact;
- Development of combined and complex protection methods.

Cathodic protection of metal structures, protection with treads and other types of electrochemical corrosion protection are widely used in industry.

Pipes and reservoirs used in oil and gas fields are subject to internal corrosion and external corrosion due to the environment, atmosphere, soil and stray currents, depending on the properties of the oil and gas system.

Equipment and devices for the development and operation of oil and gas fields in the country are becoming obsolete over the years due to corrosion. Replacing them and using other types of protective equipment requires a lot of economic costs. Therefore, there is a need to develop, test and apply corrosion protection products, using the existing opportunities in the country.

The clean surface of metals and alloys is easily exposed to chemicals under the influence of the external environment. As a result of adsorption of elements in the environment on the metal surface and the forces of surface tension, chemical reactions take place, the formation of thin layers, the change of free energy on the surface.

As a result of any corrosion process, the transition of metal atoms to the ionic state of the metal lattice, ie the formation of complex compounds of oxides, hydroxides or metals. The reaction of the surface of steel with oxygen in the atmosphere can be expressed as follows:

1) separation of oxygen from the environment, its adsorption and iron atoms connection;
2) Chemical combination of Fe ions with O ions;
3) Mutual exchange of ions;
4) Duration of interaction.

In the resulting thin layer, the mechanism of diffusion of ions as a result of oxygen in the environment continues, and the layer is enriched with new oxides, and the thickness of the layer increases with the depth of the surface. With the formation of oxide layers and its change, the concentration of elements on the surface and the electric field change.

As a result of the formation of oxide layers, the thermodynamic instability of the metal surface changes, that is, the potential of the metal electrode changes from a negative to a positive value. The phenomenon of protecting the metal from corrosion and giving its surface a good appearance is called passivation.

In the process of electrochemical corrosion, the cation formed in the metal grids begins to bond with the components in the corrosive environment. Such cases are observed in different types of metal and in the presence of at least two different mixtures of corrosive media. Therefore, the activity of metal cations is preserved in all types of solutions or electrolytes.

The process of electrochemical corrosion can be reduced not only by stopping the anode process, but also by affecting the cathode process. The most common type of cathodic process is the discharge of hydrogen ions and the recovery of dissolved oxygen.

Anode and cathode processes can occur anywhere on the metal surface where cations and electrons interact with the corrosive medium. If the surface is homogeneous, the anode and cathode processes occur the same on the entire surface of the metal. In such cases, homogeneous electrochemical corrosion processes occur.

In fact, the presence of alloying elements and other additives in the metal leads to their heterogeneous structure and the occurrence of electrochemical processes in the heterogeneous phase of the environment. In a heterogeneous system, anode or cathode processes are accelerated because the atoms of different elements are energetically different. The process has a heterogeneous electrochemical appearance.

The electrical conductivity of metals is very high, and with the appearance of excess electrons, these electrons are instantly redistributed, changing the charge density and the potential of the metal electrode over its entire surface. In particular, on the surface of the metal, electrons flow from the anode parts to the cathode parts.

The speed of movement of the environment leads to changes in the oxygen, ions and protective layers on the surface. In many cases, the increase in the rate of aggressive media accelerates the corrosion process, and in some cases corrosion-erosion and cavitation occur.

Equipment and parts used in oil and gas fields, storage, collection and processing of oil and gas products are subject to both internal and external corrosion. Internal corrosion includes the metal and its corrosion resistance, the specific corrosive properties of the resulting protective layers, as well as the oil and gas-water environment and the corrosive activity of various additives, etc. External corrosion of equipment used in this field is due to the composition of the soil, the presence of various salts and solutions in it; effects of stray currents and microbial wastes. In particular, many additives in the oil and gas-water system lead to changes in the pH of the hydrogen potential of the environment, ie the environment can change from alkaline to acidic or from acidic to alkaline.

The rate of corrosion can be reduced or increased depending on the ability of the oxygen in the solution to passivate or the polarizing properties. In many cases, the corrosion process in saline solutions is accompanied by oxygen polarization, so as the concentration of salts increases, the oxygen solubility decreases and the corrosion process slows down.

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