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CORROSION AND METAL PROTECTION

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Abstract: Corrosion is a chemical process that occurs as a result of the interaction of metals with the environment, leading to a decrease in their physical and mechanical properties. This process occurs through the oxidation of metals or the formation of other chemical compounds. Due to corrosion, metals quickly wear out, change and cause economic damage to them. Therefore, the protection of metals from corrosion is very important. Various methods are used to protect metals, such as coatings, galvanization, passivation, special anti-corrosion additives. These protection methods allow you to preserve metals for a long time and extend their service life.

Key words: Corrosion, metal protection, chemical processes, oxidation, metal coatings, galvanization, passivation, anti-corrosion additives.

Introduction: Of the 109 chemical elements of the periodic table of D. I. Mendeleev, 87 are metals and 22 are nonmetals. All metals consist of "elementary metals," "intermediate metals," "lantanides and actinides." In the periodic table, the metals in the main groups are called simple metals (s- and r-elements), and the metals in the additional groups are called intermediate metals or (d- and f-elements). It is important to protect metal objects from corrosion. The discovery of a method for producing special stainless steels will help solve this problem. Metal is used in everyday life, construction, astronautics, shipbuilding, mechanical engineering, aircraft construction, and many other industries.

Metal corrosion - the destruction of metals due to chemical or electrochemical interaction with the environment. It mainly consists of 3 stages: the entry of reactants into the phase boundary - the reaction zone; the reaction; the exit of the reaction product from the reaction zone. Corrosion (from Latin corrigere - to corrode, to corrode) - the destruction of objects (metals, concrete, stone, wood, some plastics, etc.) as a result of biological, chemical, or electrochemical interaction with the external environment. Corrosion of iron and iron alloys is also called rusting.

Methods: The corrosion process typically consists of three stages: (1) the entry of reactants into the reaction zone, (2) the reaction between the metal and the environment, and (3) the exit of the products from the reaction zone. Metal corrosion is divided into chemical and electrochemical types based on its occurrence.

Chemical (Dry) Corrosion: Occurs when metal atoms react with gases or non-aqueous liquids, often involving oxidation reactions.
Electrochemical (Wet) Corrosion: Involves the interaction of metals with aqueous solutions and is commonly seen in environments where water is present.
Additionally, corrosion can be influenced by factors such as temperature, environment aggressiveness, and material properties. Methods to reduce corrosion include:

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Improving the chemical resistance of materials.
Protecting metals from aggressive environments.
Electrochemical protection through the use of external current.
Corrosion fatigue and corrosion cracking are important forms of mechanical damage that occur under cyclic stresses and aggressive environments. Measures such as alloying steels with specific elements are used to prevent these types of corrosion.

Results: Metal corrosion, depending on the nature of destruction, is divided into the following types: flat, local, intercrystalline, and corrosive cracking. Corrosion leads to the loss of 1-1.5% of all metals collected and used by humanity annually. To protect metals from corrosion, certain measures are taken (for example, alloying elements are added: chromium, nickel, etc.).

Fig. 1. Appearance of the carozzification period and process.

By metals, we mean simple metals and their alloys, as well as products made of metals and their structures. Usually, the medium in which metal corrosion occurs is a liquid or gaseous medium. Corrosion is a heterogeneous process occurring at the interface of two phases: metal-liquid or metal-gas. According to the mechanism of occurrence, metal corrosion is divided into two types: chemical (dry) and electrochemical (wet). Chemical corrosion is a process that occurs as a result of the interaction of metal atoms with the molecules of a substance that is part of the environment, while simultaneously an oxidation-reduction process occurs. Chemical corrosion occurs when non-aqueous liquids (mainly liquid metals) and atmospheric gases interact with a metal surface.

There are 3 types of chemical corrosion:
1) Oxidative corrosion
2) Corrosion under the influence of gases
3) Corrosion caused by liquid metals

It is impossible to completely get rid of metal corrosion, you can only slow down these processes. Modern principles of reducing metal losses and protecting metals from corrosion are based on the following methods:
1. Improve the chemical resistance of materials.

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2. Protection from aggressive environments, i.e., environments that cause metal corrosion.
3. Reducing the aggressiveness of the technogenic environment towards metals.
4. Electrochemical protection of the external current input.

Figure 2. Resolution of corrosion as a result of mechanical processing.

Discussion: Corrosion-mechanical damage refers to the corrosion and mechanical damage of metals resulting from stresses, deformations, friction, and the effects of mechanical factors. General corrosion processes under the influence of external factors take on various forms and manifestations depending on the operating conditions of the parts. The most common of these are corrosion fatigue and corrosion cracking due to friction. Corrosion fatigue occurs as a result of the corrosion process of metals and alloys under the influence of an aggressive environment and cyclic stresses. The main types of crack formation during corrosion fatigue are: - corrosion environment activity; - degree of cyclic stress impact; - number of load cycles per unit of time; - strength and corrosion resistance of the alloy; To prevent corrosion fatigue, steels alloyed with optimal alloying elements are used.

Corrosion cracking occurs as a result of the action of static tensile stresses in a highly aggressive environment. Causes of corrosion cracking include: low corrosion resistance of the boundaries of particles with negative potentials separated from the enriched phases of the solid solution, the presence of an unstable structural composition in the alloy in relation to the environment, as well as a decrease in inter-crystallite strength as a result of an increase in the hydrogen content at the boundaries of the structure of the particles. [3]

The choice of materials resistant to corrosion cracking is necessarily based on the results of experimental studies. The rate of the attenuation process depends on the number of relative displacement cycles and the displacement amplitudes. Damage occurs due to the impact of liquid or gas flows moving at high speeds on the metal surface. Chemical corrosion. Corrosion of metals in non-conductive aggressive environments, such as gases heated to high temperatures, oil, gasoline, lubricating oils, etc., is called chemical corrosion. The process of chemical corrosion of metals essentially consists in the interaction of aggressive environmental components with the metal.

Conclusion: For example, when steel is heated to high temperatures in the presence of gases and air, the iron in the steel oxidizes and turns into soot. Corrosion of metals in a gas

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environment at high temperatures is a relatively simple type of corrosion. In this case, the corrosion rate depends mainly on the properties of the product layer (film) formed as a result of metal corrosion. If the film formed on the metal surface well prevents the diffusion of active particles (atoms or molecules) of the environment to the metal surface and the diffusion of metal atoms outward, then the corrosion rate of metals is low, and as this film thickens, the corrosion process decreases. finally, it stops. The properties of the film formed on the metal as a result of corrosion depend on the composition of the metal, the composition of the environment and the conditions (temperature, time, speed of the environment, etc.). Relatively thin and dense films, as well as those that adhere well to the metal surface, have high metal protection properties.

This will be. The rate of corrosion also depends on the temperature: the higher the temperature, the higher the rate of corrosion, since the process of diffusion of active atoms and metal atoms into the environment is accelerated. The rate of corrosion also depends on the susceptibility of the metal to oxygen: the higher the susceptibility of the metal to oxygen, the higher the rate of corrosion.[4]

We know that metal corrosion causes enormous damage to the national economy. This damage includes the costs of manufacturing structural materials that fail due to corrosion, metal loss in the form of irreversible corrosion products, and indirect economic losses (plant shutdowns due to lack of gas, loss of pumped gases, environmental pollution, etc.). .).) consists of the sum of costs. To protect metal products from corrosion, their materials are made of special materials or insulating coatings are formed on their surface. However, the resulting insulating coatings wear out and deteriorate over time. As a result, moisture containing dissolved salts gets on the metal, forming localized corrosive galvanic elements on its surface and causing corrosion of the product.

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