

# The Construction Industry Employs Corrosion Protection Mechanisms

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**Abstract:** Corrosion-resistant steels are becoming more prevalent in contemporary manufacturing due to their expanding range of applications. They are increasingly utilized in the construction, marine, and shipbuilding industries. They are a crucial category of long-lasting structural materials. Simultaneously, these construction materials might become highly susceptible to localized corrosion damage in specific situations. The theoretical section illustrates stainless steel categorization. The text describes the corrosion resistance of stainless steels and the various elements that influence it. The text provides a comprehensive description of all corrosion mechanisms, with a particular focus on the genesis of pitting corrosion and the impact of external influences on this specific corrosion mechanism. The study focuses on the impact of changing the chloride concentration in aqueous acids on pitting corrosion development. The experimental phase of the study involved conducting electrochemical corrosion tests to investigate the effect of chloride on stainless steel corrosion resistance. The experiments used austenitic stainless steels (AISI 321, AISI 316L, and UNS S31050), as well as duplex steel (AISI 2304) and superduplex stainless steel (AISI 2507). We tested these materials in water containing varying levels of chloride (50 ppm Cl, 1900 ppm Cl, and 19000 ppm Cl). We then measured and analyzed the electrochemical corrosion parameters. Following the experimental phase, the data was examined, and a conclusion was reached based on the findings. Kijune mentioned the topics of building construction, stainless steel, corrosion, and chlorides.

**Key words:** stainless steels, pitting corrosion, chlorides

## Introduction

Construction materials are extremely common in today's society. Unintentional damage and hazardous modifications can adversely affect the durability and lifespan of any construction material. These modifications take place from the moment the material is acquired until it is sent for disposal or recycling. Construction materials are required to possess superior mechanical qualities and machinability while also offering corrosion resistance, all at a reduced cost. With the exception of employing extremely corrosion-resistant materials like stainless steel and nickel alloys, the building material itself is rarely able to fulfill the mentioned criteria. Man extracts thermodynamically stable raw materials from nature. Through the application of energy and the manipulation and arrangement of its components, the composition of the material is altered, leading to the creation of a construction material that possesses the desired characteristics. The acquired material is in a thermodynamically precarious state and naturally tends to revert to a thermodynamically stable state. It is an undesirable, inadvertent, and detrimental occurrence that arises due to the equilibrium between natural substances and chemical reactions triggered by oxygen, water, and other atmospheric elements. By inputting energy and processing natural materials, the changes are concealed within the structure of the materials, resulting in an altered composition that preserves the desired green soybean. The metallic state has high energy due to the significant input of energy during production. Metal exhibits an inherent inclination to undergo chemical reactions with other substances, resulting in the release of energy, hence transitioning to a state of less energy. This transition is referred to as the primary

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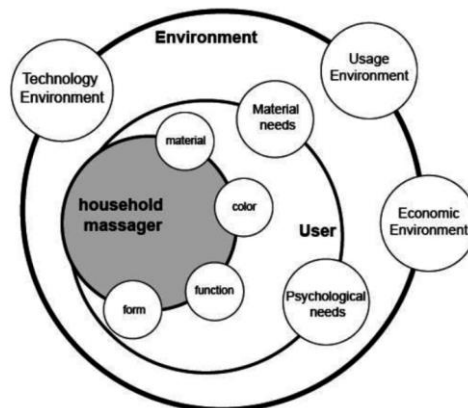
catalyst of the corrosion process. Stainless steels are a diverse collection of alloys that are resistant to corrosion. The key component in these alloys is iron (Fe), which must have a minimum of 10.5% chromium (Cr) and a maximum of 1.2% carbon (C). Stainless steel is a frequently utilized alloy because of its excellent corrosion resistance, favorable pricing, and superior machinability.

**Table 1. Causes and influences of corrosion.**

INTERNAL FACTORS-MATERIAL	EXTERNAL FACTORS-ENVIRONMENT
Composition Material	The age of the environment, the composition of the media
Spatial arrangement, size and shape of crystals	Temperature
Material texture	Pressure
Construction form	Media flow speed
Physical properties of materials	Radiation
Mechanical properties of materials	Electric charge
Defects in the material	Biological activity
Tensions in the material	

Two fundamental ideas underpin the implementation of protection.

- mitigating or eliminating the motive power
- increasing opposition to the initiation of motive power



**Figure 2. the relationship between internal and external factors**

### Research Methodology

The focus of the study This report aims to examine the effects of enhancing several techniques for protecting steel from corrosion in the construction sector. Stainless steel is extensively used in diverse industries, including construction, chemical, petrochemical, process, paper, and others. It is also utilized in the manufacturing of numerous commercial products, such as kitchen appliances and car parts. They are extensively utilized in the pharmaceutical industry and food processing facilities. Corrosion not only diminishes durability but also inflicts significant harm. Due to the significant damages and losses caused by corrosion, extensive research and development efforts are being undertaken to enhance various corrosion protection technologies. Construction and technological measures are crucial in determining the best suitable material for corrosion resistance in various application settings.

It is crucial to consider the specific operating conditions while selecting the suitable stainless steel.

### Objective of the research Lately

Research in the realm of corrosion prevention has intensified with the objective of discovering a foundational coating for metals. The fundamental coating is cost-effective, and the application process is straightforward. Several metals and alloys exhibit an ionic state with oxygen and aggressive behavior. Coating separation and corrosion occur on a metal substrate due to the combination of physical and mechanical qualities with a significant chemical component. Their limited utilization is due to inactivity, low corrosion resistance, and a surface with low resistance that is prone to wear. Applying protective coatings to the metal surface appropriately enhances mask coatings. This ensures optimal adhesion and enhances corrosion resistance and protection, resulting in a durable and wear-resistant coating. Protective coatings must possess certain characteristics in order to effectively provide outside protection. These coatings should be dense, impermeable, and adhere well to the surface through physical, chemical, or self-electrochemical operations, or a combination of these methods.

**Research assignments** The application of compact protective coatings that offer external protection is necessary.

Non-porous materials can achieve impermeability through several methods, such as physical or chemical means, as well as by having the ability to adhere well and undergo self-electrochemical processes, either individually or in combination. The goal is to investigate how chloride ion concentrations affect the corrosion of potable stainless steel. Conduct electrochemical corrosion experiments on AISI 316L and AISI 3D1 austenitic steels, as well as on the superaustenitic steel UNS S31050. Analyze the characteristics of duplex steel (AISI 304) and superduplex steel (AISI 507). In order to examine the impact of water with varying chloride concentrations, a medium containing water with chloride contents of 50 ppm Cl, 1900 ppm Cl, and 19000 ppm Cl was utilized.

### Research hypotheses Initial supposition Hello:

By increasing the concentration of chloride in the solution, the material's corrosion rate is slightly increased.

### Auxiliary hypotheses:

H1: After testing in all three solutions, there was no change in the material's height due to decomposition.

H2: The AISI 316L sample exhibits a pronounced susceptibility to corrosion in liquids containing elevated levels of chlorine.

H3: Surface degradation of materials is observed as a result of decomposition after exposure to solutions containing 1900 ppm Cl and 19000 ppm Cl.

H4: After testing in all solutions, the forging material's surface remains intact.

### Structure and research methodologies overview Prior to the commencement of the examination

The chemical composition of the examined samples has been verified. The samples were subjected to quantitative chemical analysis using non-destructive X-ray fluorescence spectrometry (KSRF) on KSRF-Olympus equipment, namely the Innov-Ks Systems, Inc., USA, model: DS 4000-C, in the FSB material protection laboratory. The experimental phase of the study involved conducting electrochemical experiments on various types of stainless steel in a solution with varying concentrations of chloride ions. The experiments were conducted at the premises of the mining and metallurgical conglomerate Trepca in Mitrovica. The corrosion resistance of steels AISI 316 and AISI 321, superaustenitic steel UNS S31050, and duplex steel AISI 304 and superduplex AISI 507 was evaluated. Water containing 50 parts per million (ppm) of chloride ions (Cl<sup>-</sup>), water containing 1900 ppm of chloride ions, and water containing 19,000 ppm of chloride ions were utilized as the medium. Classified. The Tafel extrapolation method was used to evaluate the risk of corrosion. The corrosion potential, E<sub>kor</sub>, was derived by recording E-t diagrams, while the material resistance, R<sub>p</sub>, was established by recording polarization curves.

The cyclic polarization method was used to determine the passivation surface and forging potential in the epitite of the steel under examination. Experiments were conducted at a temperature of 0 °C using aqueous solutions with varying concentrations of chloride ions (Cl<sup>-</sup>).

- Water containing 50 parts per million (ppm) of chloride ions (Cl<sup>-</sup>).
- Water contaminated with chlorides, containing 1900 ppm of chloride ions (Cl<sup>-</sup>).
- Water containing a concentration of 19000 parts per million of chloride ions (Cl<sup>-</sup>)

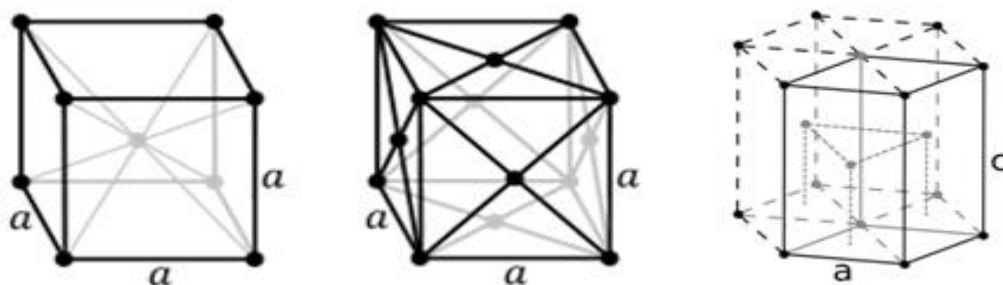
**Statistical data processing refers to the analysis and manipulation of numerical information using statistical methods.**

The data underwent statistical processing, which involved the calculation of descriptive statistics such as the arithmetic mean, standard deviation, range of variability, median, percentage share, coefficient of variability, and frequency of occurrence. Additionally, non-parametric tests were conducted to analyze the frequencies of two dichotomous variables, including the chi-square test and Fisher's exact test. Additionally, a parametric t-test was employed to compare the difference between two distinct samples within the population. The normality of the sample distribution was assessed using Shapiro-Wilk's W-test. The tests described are evaluated based on the probability parameter  $p = 0.05$ , which indicates their level of importance. The data derived from the analysis of the patient sample is also visually shown. The measured and empirical data values were subjected to statistical analysis using the SPSS dO.0 software package for Windows. Graphs were created using Microsoft Excel 4007 and SPSS dO.0. Descriptive statistical approaches were employed.

### Stainless steel metallurgy

Stainless steel, similar to other metals, is composed of atoms. The atoms are organized in a specific way, and when this pattern repeats, it creates a microscopic structure similar to brickwork. If the resulting structure is repeated, complete the metal. When observed without magnification, the various structures appear to be similar. However, when examined under a microscope, significant differences become apparent. It is these differences that determine the qualities of steel. Stainless steels consist of two primary microstructures: body-centered cubic (BCC) crystal lattice and face-centered cubic (FCC) crystal lattice. The FCC crystal lattice consists of one crystal lattice vertex at each corner of the unit cell, as well as an additional vertex at the midpoint of each side of the unit cell. The unit cell's crystallographic vectors have equal magnitudes, with  $a = b = c$ , and the angles between them are all 90°. The BCC crystal lattice consists of one crystal lattice evor located at each corner of the unit cell, as well as an additional evor positioned in the middle of the unit cell. The unit cell's crystallographic vectors have equal magnitudes, with  $a = b = c$ , and the angles between them are all 90°.

Figure 4 displays the crystal lattice structures of FCC (face-centered cubic) and BCC (body-centered cubic).



The crystal lattice is space-centered cubic. The crystal lattice is a plane-centered cubic structure. The values of  $a$ ,  $b$ ,  $c$ ,  $B$ , and  $y$  are all equal to 90°.

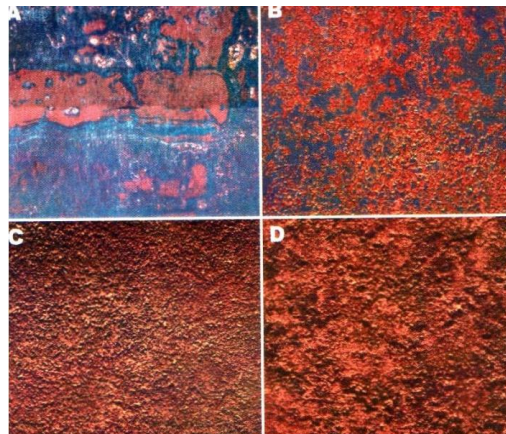
Figure 4 displays the crystal lattices of the FCC (face-centered cubic) and BCC (body-centered cubic) structures [4]. The values of  $a$ ,  $c$ ,  $B$ , and  $y$  are all equal to zero, and  $y$  is also equal to 90 degrees.

The composition of steel determines its structural properties, since specific alloy elements either stabilize the steel in the ferrite phase or shift it into the austenite phase. The essential elements for the production of the ferrite phase, in addition to iron, are chromium, molybdenum, and silicon. Titanium and niobium act as ferrite stabilizers, binding carbon and promoting austenite aging. Nickel, manganese, and nitrogen are the key components necessary for the creation of austenite. Alloy steels can have multiple stable phases due to the presence of numerous alloying elements in relatively high concentrations. Nevertheless, further processing has the ability to alter the phase structure of alloy steel. Understanding thermodynamic processes allows one to predict the phase that will manifest at a given temperature.

**Stainless steels' ability to withstand corrosion** Corrosion resistance refers to the capacity of a material to withstand the damaging effects of a corrosive substance.

Chromium modulates its effect to a varying degree. Chromium is the primary factor responsible for alloy steel's corrosion resistance, with a minimum mass fraction requirement of 12%. Chromium must fully dissolve within the metal structure to ensure proper integration, and it should not be a constituent of other structural compounds. When oxygen from the air dissolves chromium, it forms a permanent oxide coating on the surface. This layer effectively stops any additional corrosion from occurring under normal circumstances. It is crucial for the steel to have a monophasic microstructure to prevent the production of a galvanic element. The chromium mass fraction determines the corrosion resistance of steel at high temperatures. Alloys that have a high chromium content exhibit exceptional resistance to corrosion when exposed to temperatures of 900°C. Unlike gold or platinum, stainless steels do not qualify as noble materials. Stainless steels actually achieve corrosion resistance by forming a very thin, transparent, and non-soluble coating of chromium, iron oxide, and hydroxide. This layer, known as the passive film, is only a few nanometers in thickness. This passive layer can form spontaneously in an environment with sufficient oxidants. Repassivation occurs when a layer is mechanically damaged.

Figure 5



Illustrates the process of safeguarding stainless steel and its subsequent restoration of passivity in the event of damage.

The appearance of the protective layer determines the value. At very high potentials, corrosion happens very quickly again because the oxygen evolution threshold is already very high. This makes the metal oxidize at a higher valence state, which stops protective layers from forming.

### Corrosion characteristics of the primary alloying elements found in stainless steels

#### Chromium

Pure chromium is exclusively utilized as a coating to safeguard steel from corrosion or to achieve a durable and mechanically resilient surface. It undergoes rapid passivation, making it resistant to atmospheric conditions and different gases at elevated temperatures (up to approximately 980 °C). Sulfur compounds are non-corrosive to it. Therefore, it is employed in oil refineries. It exhibits resistance to hydrochloric acid, alkaline acids, and activating



ions (such as CT) in addition to a reductive environment. Due to its substantial turdoé, it exhibits a high level of resistance to both abrasion and erosion.

#### **Nickel exhibits a high level of resistance to corrosion.**

It has excellent resistance to water, alkalis, and organic compounds. However, it is susceptible to dissolution by chloride, sulfuric, and nitric acids, particularly at higher temperatures. Nickel is resistant to corrosion in both natural and sea water, which is significant considering that water is a typical cause of corrosion. However, if a layer of microorganisms develops on the surface, corrosion can occur in the presence of chloride.

#### **Copper exhibits a high level of resistance to the detrimental impacts of air corrosion.**

Due to the formation of a protective film (patina) on its surface, which consists of corrosive compounds, including basic copper sulfate. Along the coastal area, the protective layer is composed of basic copper chloride. When copper is exposed to hard water, it develops a protective layer consisting of copper oxide and hydroxide. However, in the case of soft water, copper tends to corrode, particularly if it contains carbon dioxide (CO<sub>2</sub>). Copper undergoes minimal corrosion in seawater, and its ions hinder the attachment of organisms to metal surfaces, thereby preventing fouling. Copper exhibits corrosion resistance in the presence of condensed water. Copper undergoes corrosion in the presence of air acids in the absence of oxidizing agents and also in acids that contain ammonium, sulfide, and iron ions. When copper comes into contact with steel, zinc, aluminum, or magnesium, it leads to significant corrosion of these metals. Copper exhibits resistance to organic sulfur compounds commonly present in rubber and oil.

#### **Molybdenum Molybdenum greatly enhances the ability to withstand both general and localized corrosion. They enhance the mechanical durability of steel**

However, there is a risk of the development of a secondary phase in ferritic, austenitic, and duplex steels. For martensitic steels, the hardness will rise at higher temperatures as a result of the impact on carbide hardening. The Schaeffler diagram The steel's composition can be used to determine whether it will become 100% ferritic, 100% austenitic, or a combination of the two. The Schäffler diagram is a graphical representation that illustrates the relationship between the structure of a material and the percentage of nickel and chromium present in it. Mathematical formulas [1] can be used to compute the equivalents for nickel and chromium. The equation for Niekv is calculated by adding the percentages of Ni, 30% of C, 0.5% of Mn, and 0.5% of Co. The equation for CIEkv is calculated by adding the percentages of Cr, 1.5% of Si, Mo, 0.5% of (Ta + Nb), 2% of Ti, W, V, and Al. The most intriguing line in the diagram depicts the absence of ferrite, indicated as 0%. In order to achieve a steel composition that is entirely austenitic, it is important to carefully adjust the proportions of chromium and nickel so that they fall within the austenitic range.

Figure 7 illustrates that increasing the amount of nickel facilitates the transition to the austenite phase. The diagram indicates the martensite phase as the region on the left. Only tempering can achieve the thermodynamically unstable phase. Ferritic steel with a high carbon content is the source of martensitic steel. To do this, the steel must be heated to approximately 1000°C, causing a transformation in its structure from ferritic to austenitic. We then rapidly cool the heated steel to prevent it from returning to its original ferrite phase.

#### **Concluding Considerations**

Iron contains alloying elements, like chromium and nickel, in addition to iron itself. Alloyed parts significantly improve corrosion characteristics compared to those not mixed with other substances. NerdajudiCelic ingjinvil is highly versatile and finds extensive use in the chemical, petrochemical, process, paper industry, and other sectors. It is also employed in the manufacturing of consumer goods, including household appliances and automotive components. The pharmaceutical industry and food processing companies extensively utilize these materials. Corrosion not only decreases durability but also inflicts significant damage. Due to the detrimental effects and financial losses caused by corrosion, extensive research is being conducted to develop and refine efficient techniques of corrosion protection. Constructional and technological considerations play a crucial role in

determining the best suitable material for corrosion resistance in various application settings. It is crucial to consider the specific working circumstances while selecting the suitable stainless steel. Lately, there have been endeavors to decrease the ratio of flammable, explosive, and toxic solutions in coatings and substitute solution-based coatings with more ecologically sound alternatives. Specifically, solutions refer to organic chemicals with a low molecular mass that readily evaporate and, in the process of film development, do harm to the environment and contribute to air pollution. Organic solutions containing highly reactive substances undergo chemical reactions with exhaust fumes emitted by cars and industries, particularly nitrogen oxides. These reactions result in the formation of chemicals that impact the local environment, the ozone layer, and have detrimental effects on animals' metabolism. Therefore, just a few years ago, organic solutions were acknowledged as a significant environmental issue because of their detrimental impact on the environment and Judea. To mitigate environmental pollution, recent advancements have led to the development of lower-molecular-weight coatings. These coatings are water-soluble and possess non-polluting characteristics, resulting in a reduction of waste residue. We have specifically enacted multiple restrictions to reduce the use of organic solvents. The phrase "Zbo oblinos sinacie, propsio \* pia" is unclear and fails to convey a specific meaning. The addition of porat jema naton enhances organic solution reduction.

Currently, water-soluble coatings are employed to paint a wide range of structures, including entire buildings, bridges, tanks, transport containers, automotive components, agricultural gear, metal furniture, and railway carriages. Advanced epoxy water-soluble coatings can be utilized to safeguard offshore facilities and metal components that are subjected to extremely corrosive conditions in heavy industries. These coatings are particularly effective in protecting oil and gas plants, tanks, marine and chemical plants, as well as construction sites. Although contemporary water-soluble coatings offer commendable corrosion protection, they do not match the level of protection afforded by solution-based coatings, especially in very aggressive conditions. Consequently, these technologies are still undergoing refinement in order to enhance their privacy features for end users, as they are relatively new in the business. Simultaneously, the hardening of the coating can occur in two primary ways, depending on the viscosity of the binder: through the physical evaporation of one of the solution's components (diluent) or through chemical processes, typically oxidation, inside or involving the binder. The chemical curing process, commonly referred to in literature, involves the removal of coatings through polymerization. This process entails the hardening of the coating by means of an oxidative chemical reaction with oxygen from the air. It also involves the cross-linking of unsaturated polymers with moisture from the air, or the reaction between binders and hardeners in the case of two-component coatings, which are mixed just before application. Here, the coating agent undergoes polymerization and creates a network of interconnected molecules. The resulting qualities of the coating agent are mainly influenced by the extent and characteristics of this interconnection. The surface preparation is crucial for maximizing the lifespan of the coating, as a well-prepared surface leads to a longer coating lifespan. Surface preparation involves both main and secondary operations. The main process involved in preparing porcina involves the creation of sheets and profiles that have not been previously treated to prevent corrosion. The process is primarily conducted in automated facilities. Secondary surface preparation involves preparing damaged or failing porcine components that were previously protected with shop primer. Immediately following the first preparation of the surface, a workshop base coating or shop primer is applied to the entire sheet. This coating serves as a temporary protection against corrosion during the construction of the structure, specifically until the necessary coating composition is applied. They are employed in relatively thin film thicknesses, ranging from 15 to 25  $\mu\text{m}$ , as excessive film thickness might adversely impact the speed and quality of cutting or welding. The specific criteria for these foundation coatings include: corrosion resistance during construction, suitability for application via spraying in different automated facilities, quick drying time, no adverse impact on welding or cutting speed, absence of harmful or toxic fumes during welding or cutting processes, no negative effect on welded joint properties, ability to withstand rough handling in operational and transportation conditions, water resistance, and the formation of a suitable base for all types of coating compositions. In the initial preparation process, the spherical unit is commonly employed as an abrasive agent to create a smooth shape without any sharp edges that could penetrate the thin (25  $\mu\text{m}$ ) wet coating. On the other hand, for the secondary surface preparation, a sharp edge is typically used alone to achieve a more effective bond between the coating and the metal surface. The secondary preparation of porcina also aims to eliminate diverse

impurities present on the surface, such as salt, grease, and fatty substances. It also addresses inhomogeneities caused by welding, achieving a specific level and pattern of roughness and dusting. This preparation is performed prior to the application of the specified protective coatings. The successful outcome of the painting process (coating) relies on meticulous planning of all tasks, suitable working circumstances, optimal microclimatic conditions, accurate selection of the application method, and the integrity of the personnel. The painting documentation provides detailed information on the procedures for preparing and protecting surfaces using specific types of coating compositions. It also considers factors such as the time needed for assembling and disassembling scaffolding, drying and curing times, and intervals between applying different coats. Additionally, it takes into account microclimatic conditions such as substrate temperature, dew point, ambient temperature, relative humidity, and color temperature. Strong ventilation is essential in enclosed or confined working settings to ensure overall safety and facilitate the drying of coatings. It is necessary for all surfaces that need to be coated to be easily reachable and adequately illuminated. The recommended luminous intensity for lighting should range from 500 to 1000 lux.

The substrate temperature is crucial, as it needs to be at least 3°C higher than the dew point to avoid condensation, which can lead to paint separation. The optimal ambient temperature for the application of the coating is contingent upon whether it is conducted indoors or outdoors. Additionally, we apply the coating when the relative humidity falls below 85% to avoid dew formation on the surface. The temperature of the paint is a crucial factor, as it can affect the hardening process of certain two-component paints. At low temperatures, the chemical reaction between the binder and the remover slows down significantly, leading to incomplete hardening. Furthermore, as the temperature decreases, the paint's viscosity rises, leading to diminished spreadability, making it challenging to apply the color. As the protective requirements increase, so do the requirements for work execution, quality, and oversight during painting. The surface protection technique divides monitoring into three distinct phases. Stages of control and oversight: 1. Pre-painting control: examination to see if the surface is adequately prepared for painting according to the specified standard. 2. Control while painting—interphase control of the coating—in addition to the previously specified technological methods from the previous step, the thickness of the wet film is also monitored. 3. Post-painting control entails checking the dry film's thickness. It is vital to analyze the requirements regarding the overall appearance and continuity (without holes) of the coating, as well as its adhesion and smoothness. The appropriate choice of painting technique also significantly impacts the corrosion resistance characteristics of coatings. Several methods exist for applying paint, such as brush painting and spatula application. applying paint using rollers, via the application of paint using the method of spraying ("Stranjem", "nastravanjem"), immersing and transferring fluid, Factors such as the coating type, the desired application speed, the size of the object or structure, the presence of ventilation, and the level of environmental privacy all influence electrophoresis. Controlling fouling in nature entails addressing the issue of marine creatures' attachment. When a constructed object, whether made of metal, wood, stone, or plastic, submerges in the ocean, the process of fouling begins immediately. Factors such as ocean currents, mechanical harm, salinity levels, sediment quantity, temperature, pollution, and nutrient availability can influence the complex process of fouling. The vegetation's vigor is also a seasonal occurrence that depends on the geographical region. Knowing the specific region where the ship will navigate makes it possible to evaluate the likelihood of fouling. The ships that are most at risk of endangerment are those that navigate during low tides, have minimal activity, and primarily sail in tropical and subtropical seas. The primary factors contributing to an increase in roughness are fouling and surface deterioration. Among these, the roughness of the outer plating of the underwater section of the hull has the most significant impact on frictional resistance. For slow ships, such as most commerce ships, the proportion of frictional resistance in the overall resistance can reach as high as 90%. The presence of slime on the underwater part of a ship's hull is commonly believed to result in a 1-2% increase in resistance. Sea grass, on the other hand, can cause a 10% increase in resistance, while shells on the bottom can lead to as much as a 40% increase. The presence of fouling on the ship's surface leads to increased maintenance expenditures since the ship needs to be dried at the dock, and surface preparation and coating require additional time and resources. Additionally, fouling negatively impacts the ship's agility. The environmental consequences are clearly significant, as heightened fuel consumption leads to heightened emissions of detrimental



gases (CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>x</sub>) and prompts the migration of marine species from their native habitats to regions where they can pose a risk to ecological equilibrium. Aside from the weight gain caused by fouling in underwater structures, the problem often lies in the anaerobic corrosion of metal surfaces. This corrosion happens when fouling creates a barrier between the seawater and the surface, leading to increased resistance and shear stresses. This barrier is a microenvironment characterized by an acidic pH, a high concentration of Cl<sup>-</sup> ions, and a lack of oxygen. These parameters create a favorable environment for the growth of anaerobic bacteria and the initiation of microbiological corrosion through their actions. This study's experimental phase involved a test to determine how chloride ion concentration affects the occurrence of pitting corrosion in stainless steels. Electrochemical corrosion experiments were conducted on austenitic steels AISI 316L and AISI 3L, as well as on superaustenitic steel UNS S31050. Tests were conducted on the characteristics of AISI 304 duplex steel and AISI 507 superduplex steel. The medium for the experiment was water with varying concentrations of chloride, specifically 50 parts per million (ppm) Cl<sup>-</sup>, 1900 ppm Cl<sup>-</sup>, and 19000 ppm Cl<sup>-</sup>. Specific examined samples showed a decrease in corrosion resistance as the chloride level increased. Austenitic steels AISI 316L and AISI 3L exhibited visible corrosion when exposed to a solution containing 1900 ppm Cl<sup>-</sup>, leading to the formation of pits. The duplex steel alloy AISI 304 exhibited a propensity for pitting corrosion when exposed to a solution containing 19000 parts per million (ppm) of chloride (Cl<sup>-</sup>). The superaustenitic UNS S31050 steel and superduplex AISI 507 steel exhibited no propensity for pitting as the chloride concentration in the solution increased. The test results revealed that chloride (Cl<sup>-</sup>) has a significant impact on the commencement and degree of corrosion damage. This highlights the importance of selecting the appropriate type of stainless steel based on the chloride content in the water.

### Summary

The utilization of corrosion-resistant steels in modern production has been steadily growing due to their expanding range of applications. Construction, nautical industries, shipbuilding, and other related fields commonly employ them. They are considered a very significant category of materials that are resistant to structural corrosion. Simultaneously, these materials exhibit a high susceptibility to localized corrosion in specific environmental circumstances. The theoretical section presents an overview of the several classifications of stainless steels. The text provides a description of stainless steel's corrosion resistance, including an explanation of the factors that influence corrosion resistance and the causes of corrosion. Significant attention was focused on the issues related to pitting corrosion as well as the impact of external influences on the process of perforation corrosion. The study specifically examined the impact of changing the chloride concentration in water-based solutions on the development of pitting corrosion. The experimental section involved conducting electrochemical corrosion tests to investigate the impact of chloride corrosion on the corrosion resistance of stainless steels. We evaluated the corrosion resistance of various stainless steels, including AISI 321, AISI 316L, UNS S31050, AISI 2304, and AISI 2507, in water samples with varying chloride concentrations (50 ppm Cl<sup>-</sup>, 1900 ppm Cl<sup>-</sup>, and 19000 ppm Cl<sup>-</sup>). We determined the electrochemical corrosion parameters for each steel. Following the experimental phase, the results were examined, and based on the findings, a conclusion was reached.

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