CSA POLYANILINE ANTI-CORROSION COATING:

Redefining the Future of Metal Corrosion

100 FAQs

PART 1: PREFACE

Q1: Why does metal corrode? How severe is the hazard of corrosion?

Why is corrosion protection necessary?

A: Metal corrosion is a spontaneous and irreversible process.

Except for a few precious metals like gold, platinum, and palladium, most metals are highly reactive with corrosive media in natural environments, undergoing chemical or electrochemical reactions. They transform from high-energy metallic elements or alloys back into thermodynamically relatively stable compounds, completing the process of metal corrosion.

The factors causing metal corrosion are complex, typically including chemical corrosion, electrochemical corrosion, and galvanic corrosion between metals with different electrochemical potentials.

Theoretically, the above reactions are difficult to eliminate completely, so metal corrosion is unavoidable and can only be mitigated through anti-corrosion solutions to ensure the service life of the metal.

Metal corrosion not only causes huge economic losses but also brings significant safety hazards. Economic losses due to corrosion account for 4% of annual GDP, resulting in approximately USD 2.5 trillion in direct economic losses worldwide each year.

There have been numerous major safety accidents domestically and internationally caused by corrosion leading to a decrease in the load-bearing capacity of bridges and tunnels, and collapses due to delayed maintenance and repair.

Q2: What are the common technical solutions for metal anti-corrosion?

Which solution is the most economical and convenient to construct?

A: There are many technical solutions for metal anti-corrosion.

Adding nickel or chromium to create corrosion-resistant alloys, such as stainless steel, is effective but has poor durability in extremely corrosive conditions. Galvanizing processes like electro-galvanizing and hot-dip galvanizing pose ideal anti-corrosion effects, but they

still face challenges of high costs, high energy consumption and pollution during manufacturing, and difficulty in anti-corrosion for large metal components.

On-site construction is difficult, especially during maintenance, hence greatly limiting their application. Coating a large anti-corrosion paint on the metal surface is currently the most cost-effective metal anti-corrosion technology. It is convenient for both construction and maintenance, thus becoming the primary technical solution in the field of metal anti-corrosion.

Q3: What is metal anti-corrosion coating?

What are the types of anti-corrosion coatings?

A: Metal anti-corrosion coatings are divided into conventional anti-corrosion coatings and heavy-duty anti-corrosion coatings.

Conventional anti-corrosion coatings protect metals from corrosion in general atmospheric environments. Heavy-duty anti-corrosion coatings refer to those that can provide longer protection than conventional anti-corrosion coatings in relatively harsh corrosive environments such as industrial and marine atmospheres.

Types of metal anti-corrosion coatings include lead and chromium anti-corrosion coatings, zinc-based anti-corrosion coatings, and polyaniline anti-corrosion coatings. Although lead and chromium anti-corrosion coatings have excellent anti-corrosion performance and are inexpensive, their high toxicity poses significant environmental hazards and they are gradually being phased out.

Currently, zinc-based anti-corrosion coatings using zinc powder as the anti-corrosion material are the dominant products in the market. Polyaniline anti-corrosion coating is a zero-zinc, fully polymeric anti-corrosion product. Due to its unique anti-corrosion mechanism and ultra-long-term anti-corrosion performance, it is rapidly becoming a most important choice for metal anti-corrosion coatings.

Q4: What are the types of zinc-based anti-corrosion coating products?

What are their advantages and disadvantages?

A: Zinc-based anti-corrosion coating products include three major categories: organic zinc-rich, cold galvanized, and inorganic zinc-rich anti-corrosion coatings.

Organic zinc-rich anti-corrosion coatings are typically epoxy zinc-rich coatings. Their anti-corrosion lifespan depends on the zinc powder content. With over 80% zinc powder content, they can achieve an anti-corrosion lifespan of over 10 years.

Cold galvanized anti-corrosion coatings are single-component zinc-rich coatings with even higher zinc powder content, and their dry film has a zinc content as high as 96%.

Inorganic zinc-rich anti-corrosion coating products include both water-based and solvent-based types. Inorganic zinc-rich anti-corrosion coatings have advantages such as resistance to 400°C high temperature, fast drying speed, and good anti-corrosion performance.

The biggest drawbacks of this coating are its difficult application, high requirements for substrate surface treatment, and the need for high relative humidity in the coating environment, continuous stirring, long recoating times, and poor film toughness, which limit its large-scale promotion and application.

The advantages of organic zinc-rich anti-corrosion coatings are that their anti-corrosion performance is widely recognized by the industry, their anti-corrosion mechanism is well-understood and validated by numerous actual cases, and the preparation process is relatively simple, with complete solutions for construction, quality inspection, and acceptance.

The disadvantages of organic zinc-rich anti-corrosion coatings are that their anti-corrosion durability is about 10-15 years, far less than the 30-year anti-corrosion lifespan for large steel structures. Throughout the world service life, multiple large-scale repairs and maintenance are required, with maintenance costs exceeding new construction costs by more than 5 times. Another potential disadvantage is the over-reliance of zinc-rich coatings on zinc ore resources. China's zinc ore reserves account for only 20% of the world's total, facing high foreign dependence and difficulty in achieving production industry chain independence and controllability issues.

Cold galvanized anti-corrosion coating is a high-zinc content anti-corrosion coating composed of zinc powder with a purity higher than 99.9%, volatile solvents, and organic resin. Its advantage is relatively excellent anti-corrosion performance, reportedly achieving an anti-corrosion lifespan of over 15 years. However, this coating also presents application difficulties, requires continuous stirring, and its adhesion is only 3 MPa, posing a risk of film detachment during service.

Q5: What is the anti-corrosion mechanism of zinc-rich anti-corrosion coatings?

A: Taking the protection of iron by zinc-rich coatings as an example, its anti-corrosion mechanism is that the zinc powder is continuously consumed as a sacrificial anode, while iron serves as the protected cathode, thus preventing rust.

Specifically, the electrode potential of zinc is more negative than that of iron, making zinc more active and acting as a sacrificial anode. Iron is the cathode, and current flows from zinc to iron. The anodic zinc is consumed and corroded, while the cathode iron is protected.

Therefore, this mechanism requires a sufficiently high zinc powder content to meet long-term anti-corrosion requirements, and its anti-corrosion performance is positively correlated with the zinc powder content. For heavy-duty anti-corrosion coatings exceeding 15 years, the weight content of zinc powder must exceed 70%.

Q6: Are there new anti-corrosion materials that can replace zinc powder?

Are there zero-zinc anti-corrosion coatings?

A: The anti-corrosion effect and lifespan of polyaniline coatings have been fully validated by academia and industry. It is currently one of the very few products that can replace zinc-based anti-corrosion coatings.

Polyaniline coating is the only zero-zinc metal anti-corrosion coating.

Q7: What is polyaniline?

How were its anti-corrosion properties discovered?

A: Polyaniline is a long-chain conjugated polymer composed of two repeating units, p-phenylenediamine and quinonediamine.

Professor Alan G. MacDiarmid of the University of Pennsylvania discovered in 1983 that polyaniline is an intrinsically conductive polymer. He shared the 2000 Nobel Prize in Chemistry for contributions to conductive polymers.

The first to discover the anti-corrosion properties of polyaniline was the French scientist Deberry. In 1985, Deberry et al. synthesized a polyaniline film on stainless steel using electrochemical methods. This film reduced the corrosion rate of stainless steel by two orders of magnitude, showing potential anti-corrosion properties.

Q8: What is the development status of the polyaniline anti-corrosion coating industry in China?

A: Academician Wang Fosong of the Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, was the first in China to conduct research on the synthesis, structure, and application of polyaniline as early as 1983.

Subsequently, a research team led by Professor Wang Xianhong (Dr. Wang Fosong's doctoral student) began fundamental research on the application of polyaniline anti-corrosion in 1997, demonstrating that the anti-corrosion mechanism of polyaniline originates from its unique reversible redox reaction.

They solved the key industrialization technology for polyaniline resin and developed high-solids polyaniline anti-corrosion coatings (solids content > 75 wt%).

Through collaboration between the Changchun Institute of Applied Chemistry and Hunan Ben'an Yada New Materials Co., Ltd., polyaniline anti-corrosion coatings transitioned from laboratory research to industrialization, establishing the world's first ten-thousand-ton-level polyaniline anti-corrosion coating production line.

During this period, they participated in the formulation of several industry technical standards for polyaniline anti-corrosion technology, and their products have been widely applied in fields such as bridges, highways, airport terminals, high-speed rail, and oil storage tanks.

Q9: What is the anti-corrosion principle of polyaniline?

A: Polyaniline possesses unique reversible redox properties. Its electrode potential is higher than that of most metals like iron and aluminium, causing the surface of the contacted metal to be slowly oxidized. This slow oxidation reaction forms a dense oxide film on the metal surface, preventing further corrosion of the steel structure by corrosive media.

During this reaction process, the polyaniline molecule is reduced to a state of polyaniline with an electrode potential lower than that of oxygen. Then, under the action of oxygen in the atmosphere, it is re-oxidized to its initial state, completing a "polyaniline reversible cycle."

Polyaniline is not consumed during the entire process, but it forms a dense oxide film on the metal surface. Therefore, a small amount of polyaniline can achieve long-term anti-corrosion performance for the coating.

Q10: How is the anti-corrosion principle of polyaniline different from that of zinc-rich paint?

A: The anti-corrosion principle of polyaniline anti-corrosion coating lies in the unique reversible redox properties of polyaniline.

Polyaniline is not consumed during the entire process but forms a dense oxide film on the metal surface, thereby "activating" the steel's own defense capabilities to form a dense oxide protective film on its surface, achieving anti-corrosion.

Furthermore, the polyaniline content does not decrease during its service life. Zinc-rich paint protects steel by "constantly sacrificing itself."

As time goes by, the zinc powder content decreases. Once the zinc powder is consumed, the anti-corrosion performance disappears.

Therefore, the effective film thickness of zinc-rich paint continuously decreases as the zinc powder is consumed, eventually losing its anti-corrosion performance.

In summary, zinc-rich paint is "sacrificial" anti-corrosion, while polyaniline is "activation" anti-corrosion, with fundamental differences.

Q11: Are there mature polyaniline anti-corrosion coating products available?

A: According to market research reports, polyaniline anti-corrosion coating technology is mature.

German Ormecom company launched the Corpusative brand of polyaniline anti-corrosion coating products as early as 1996.

Domestic production has been realized since 2005, with commercialized products available. For instance, Hunan Ben'an Yada New Materials Co., Ltd. has a ten-thousand-ton-level polyaniline anti-corrosion coating production line, and its products have been widely applied in major typical domestic projects.

Q12: Besides having anti-corrosion capabilities for iron, how does polyaniline anti-corrosion coating perform on other metals?

A: Polyaniline has a higher electrode potential than most metals.

Therefore, in addition to ferrous metals, it also provides anti-corrosion protection for most metals and alloys such as zinc, aluminium, copper, magnesium, aluminium alloys, and magnesium alloys.

This is the universal anti-corrosion property of polyaniline anti-corrosion coatings, which has been validated academically and demonstrated in actual construction cases such as copper/iron bolts and iron/galvanized layers.

Zinc-rich coatings rely on the sacrificial anode principle and only provide anti-corrosion for iron. They do not offer anti-corrosion for metals more active than zinc, such as aluminium, zinc, and magnesium alloys.

Q13: Does polyaniline anti-corrosion coating have anti-corrosion properties for concrete?

A: Concrete structures experience severe damage after 10-15 years of use, far short of their designed lifespan of 50-100 years, and the cost of repair and reinforcement is three times the cost of new construction.

The most significant source of concrete corrosion is the corrosion of reinforcing steel. Once the alkaline environment of the reinforcing steel embedded in concrete structures is destroyed or chloride ions penetrate, numerous micro-corrosion cells form on the surface of the reinforcement steel.

Iron loses electrons and gradually forms $Fe(OH)_3$, which accumulates on the surface of the reinforcing steel and concrete, generating significant expansive stress, leading to continuous cracking and spalling of the concrete cover.

Polyaniline anti-corrosion coating can provide dual protection for both concrete and embedded reinforcing steel. The film-forming resin component...

Q14: Is polyaniline anti-corrosion coating an environmentally friendly coating?

A: Polyaniline anti-corrosion coatings include four major product categories: high-solids polyaniline anti-corrosion coatings (solids content >75 wt%), waterborne polyaniline anti-corrosion coatings, polyaniline powder coatings, and UV-curable polyaniline anti-corrosion coatings.

Polyaniline anti-corrosion coatings do not contain heavy metals like lead and chromium, thus do not cause heavy metal pollution to the environment. Their VOC content is below 350 g/L, making them environmentally friendly coatings.

Q15: Is polyaniline anti-corrosion coating a good product?

A: Polyaniline anti-corrosion coatings can be applied to the anti-corrosion of metal, alloy, and concrete structures, including but not limited to bridges, highway guardrails, rail transit, large building steel structures, pipelines, heavy machinery, ships, and port facilities.

Q16: What is the cost-effectiveness of polyaniline anti-corrosion coatings?

A: According to the performance requirements of heavy-duty anti-corrosion coatings, the zinc powder weight content in zinc-rich coatings must be greater than 80% to meet anti-corrosion needs.

Polyaniline anti-corrosion coatings have lower density. For the same film thickness, the application area of polyaniline anti-corrosion coatings is more than 1.5 times that of zinc-rich coatings, and the anti-corrosion lifespan is long, greatly reducing maintenance costs during operation.

Therefore, polyaniline anti-corrosion coatings have very high cost-effectiveness, reducing maintenance costs by more than 50% without increasing coating costs.

Q17: Compared to zinc-rich paint, what are the advantages of polyaniline anti-corrosion coatings?

A: First of all, the long-lasting anti-corrosion advantage, the anti-corrosion life of polyaniline anti-corrosion coating is usually 30 years above, while the anti-corrosion life of zinc-rich paint is usually 10-15 years.

The second are the independent and controllable industrial chain advantages. Polyaniline is the core material in polyaniline anti-corrosion coatings from aniline, and the domestic production capacity is from aniline. It is controllable, while zinc-rich paint relies on zinc ore resources, 80% of which comes from overseas, facing sustainability supply security issues.

The third is the maintenance cost advantage, polyaniline anti-corrosion coating in the steel structure. During the whole life cycle of use, the number of maintenance times is less than 2 times, and zinc-rich paint usually needs 3-4 times.

Polyaniline anti-corrosion coatings reduce the maintenance cost in the later stage and have obvious market competitive advantages.

Q18: Are there industry standards for polyaniline anti-corrosion coatings? Are there specifications for construction?

A: Relevant industry technical standards for polyaniline anti-corrosion coatings exist in multiple application fields, including JT/T 722-2026 ".

Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures," JT/T 600-2025 "Powder Coatings and Coatings for Corrosion Prevention for Road Applications," and JT/T 695-2026 " Anti-corrosion Coating for Highway Bridge Concrete Structures."

Q19: Does polyaniline anti-corrosion coating contain zinc powder?

A: The anti-corrosion material in polyaniline anti-corrosion coatings is polyaniline. It does not contain zinc powder.

Q20: What is the polyaniline content in polyaniline anti-corrosion coatings?

A: The polyaniline content in polyaniline anti-corrosion coatings ranges from 1-5%.

Q21: How to detect the polyaniline content in anti-corrosion coatings?

A: The polyaniline content in polyaniline anti-corrosion coatings can be tested according to the local standard DB43/T 2421-2022 " Determination of Polyaniline Content in Polyaniline Anti-corrosion Coatings."

Q22: What is the impact of polyaniline content on anti-corrosion performance?

A: Polyaniline content has a significant impact on anti-corrosion performance. To achieve long-term anti-corrosion requirements for the design life, the polyaniline content in the anti-corrosion coating should be between 1-5 wt%, and the average particle size of polyaniline should be between 0.5-10 microns.

Q23: Is polyaniline anti-corrosion coating single-component or two-component?

A: High-solids polyaniline anti-corrosion coatings and waterborne polyaniline anti-corrosion coatings are both two-component products and are mixed and used on-site. Thermosetting polyaniline powder coatings and UV-curable polyaniline coating is single-component.

PART 2: PERFORMANCE

Q24: What is the anti-corrosion lifespan of polyaniline coatings?

A: The anti-corrosion lifespan of polyaniline coatings can reach over 30 years, which is 2-3 times that of epoxy zinc-rich heavy-duty anti-corrosion coatings.

Q25: How is the acid, alkali, and salt resistance of polyaniline anti-corrosion coatings?

A: Polyaniline anti-corrosion coatings have excellent chemical resistance, withstanding acid, alkali, and salt erosion, especially exhibiting a significant inhibitory effect on "pitting corrosion" caused by chloride ions.

Furthermore, this anti-corrosion coating still maintains excellent anti-corrosion performance under "three high" extreme conditions of high temperature (80-120℃), high humidity (relative humidity > 90%), and high salt (salt content greater than 3.5 wt%).

Q26: Does polyaniline anti-corrosion coating have anti-corrosion properties at high temperatures?

A Traditional zinc-based anti-corrosion coating wanes in terms of performance above a temperature of 60℃.

In contrast, Polyaniline performs excellent between a high temperature of 80℃ and 120℃.

Q27: How is the adhesion of polyaniline coatings?

A: Polyaniline can form chemical bonds with the metal substrate. It can form coordination bonds with iron atoms, greatly enhancing the interaction force between the polyaniline anti-corrosion coating and the metal, with adhesion ≥ 9 MPa, far exceeding the 5 MPa of zinc-rich coatings.

Q28: How is the light aging resistance of polyaniline?

A: Polyaniline anti-corrosion coatings are mainly used as primers and intermediate coats.

Although polyaniline itself has good stability and weather resistance, the film-forming resin has poor light aging resistance, making it unsuitable for topcoats.

In specific applications, to improve the weather resistance of the coating, a weather-resistant silicone paint, acrylic polyurethane paint, or fluorocarbon paint is typically applied over the polyaniline anti-corrosion coating to form a composite coating and enhance light aging resistance.

Q29: Does polyaniline anti-corrosion coating have antifouling properties?

A: The primary function of polyaniline coating is anti-corrosion. It has some antifouling properties, but they are limited.

However, its antifouling performance can be enhanced by compounding it with other antifouling agents.

Q30: What is the dry film thickness of the anti-corrosion coating?

A: The anti-corrosion coating thickness varies depending on the atmospheric environment.

For polyaniline anti-corrosion primers used alone, a thickness of 60-80 μm is recommended.

For composite coatings, a total thickness of "primer + intermediate coat + topcoat" of 200-340 μm is recommended.

Specific details can be adjusted according to JT/T 722-2026 "Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures."

Q31: What is the volume solids content of polyaniline anti-corrosion coating?

What is the theoretical coverage rate?

A: The volume solids content of polyaniline anti-corrosion coating is 65±2%. The theoretical coverage rate is 8.13 m^2/L (at 80 μm dry film thickness), which is much higher than that of zinc-rich coatings.

Q32: What is the specific gravity of polyaniline anti-corrosion coating?

Will it increase the structural weight?

A: Polyaniline anti-corrosion coating weighs 1.6kg/L, lower by 40% when comparing with zinc-based anti-corrosion coatings, reducing the equipment-load and spare parts loading for bridges.

Q33: What is the level of the coating?

A: Excellent flexibility, impact resistance of 50 cm, bending of 2 mm, and adhesion greater than 9 MPa, making the paint film not prone to cracking.

Q34: How is the scratch resistance of polyaniline coating?

A: Polyaniline anti-corrosion coating can resist scratches. This is because once the polyaniline anti-corrosion coating is scratched, polyaniline rapidly consumes oxygen near the scratch, promoting the formation of a dense oxide layer on the metal at the scratched area, thereby protecting the scratch.

Q35: Is polyaniline anti-corrosion coating fireproof?

A: Polyaniline anti-corrosion coating has limited fireproof performance and is not classified as a fire-retardant coating.

If fireproof functionality is required, a layer of intumescent or non-intumescent fire-retardant coating can be applied over the polyaniline anti-corrosion coating to achieve fireproof requirements.

The compatibility between polyaniline anti-corrosion coating and fire-retardant coatings is excellent.

Q36: What is the colour of polyaniline anti-corrosion coating?

How is its coating colour achieved?

A: Polyaniline anti-corrosion coating has a gray appearance and is suitable for use as a primer or intermediate coat. It can be paired with different coloured topcoats to create composite coatings, achieving various appearances such as colourless, gray, and green according to customer requirements.

Q37: What is the shelf life of the product?

A: Polyaniline anti-corrosion coating, when stored sealed in a cool, dry place, has a shelf life of 12 months in unopened condition.

After this period, it needs to be inspected, and if it passes inspection, it can still be used.

Q38: How is the compatibility of polyaniline anti-corrosion coating?

A: Polyaniline anti-corrosion coating exhibits excellent compatibility. It can be used as a primer and intermediate coat and can be paired with oil-based or water-based silicone, acrylic polyurethane, and fluorocarbon topcoats. It has excellent interlayer adhesion and good compatibility.

Q39: Can polyaniline anti-corrosion coatings be applied to rusted surfaces?

A: There are specialized rust-tolerant polyaniline coatings available that can achieve rust-tolerant application of polyaniline anti-corrosion coatings.

Q40: Can polyaniline anti-corrosion coatings be made waterborne?

What is their performance?

A: Polyaniline anti-corrosion coatings can be made waterborne. Waterborne polyaniline anti-corrosion coatings can achieve neutral salt spray resistance exceeding 1440 hours, meeting anti-corrosion requirements for over 5 years.

Q41: Are polyaniline anti-corrosion coatings hazardous chemicals?

A: Among the polyaniline anti-corrosion coating products, high-solids polyaniline anti-corrosion coatings contain a small amount of volatile organic solvents and are classified as hazardous chemicals, requiring storage and transportation in accordance with hazardous chemical regulations.

Waterborne polyaniline anti-corrosion coatings, UV-curable polyaniline anti-corrosion coatings, and polyaniline powder coatings do not contain volatile organic solvents and are not classified as hazardous chemicals.

Q42: Are there construction and acceptance standards for polyaniline anti-corrosion coatings?

A: Polyaniline anti-corrosion coatings have industry technical standards for application on highway bridge steel structures and concrete structures.

Construction and acceptance standards can be followed according to JT/T 722-2026 "Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures" and JT/T 695-2026 "Anti-corrosion Coating for Highway Bridge Concrete Structures," respectively.

Q43: Polyaniline vs. zinc-rich primer, which anti-corrosion coating has better development prospects?

A: The lifespan of polyaniline anti-corrosion coatings is 10-15 years longer than that of zinc-rich primers, with lower unit application costs and a 40% reduction in weight, offering high cost-effectiveness.

Polyaniline anti-corrosion coatings are environmentally friendly coatings that do not release heavy metals like zinc. Their raw materials are widely sourced, and the industry chain is independently controllable.

Zinc-rich coatings release heavy metals like zinc during their service life, and their raw materials are limited by overseas zinc ore resources, raising concerns about sustainable supply.

In the long term, polyaniline anti-corrosion coatings have greater "staying power" and greater development potential.

Q44: Polyaniline anti-corrosion intermediate coat vs. epoxy micaceous iron oxide intermediate coat, which is superior?

A: Epoxy micaceous iron oxide intermediate coats primarily provide barrier and isolation against corrosive media through micaceous iron oxide components, belonging to physical protection.

In contrast, polyaniline in polyaniline anti-corrosion intermediate coats forms a dense passivation layer through the "channel" between itself and the bottom coat, further enhancing steel corrosion protection, thus belonging to chemical protection with superior performance.

Q45: Is polyaniline anti-corrosion coating a rust-preventive paint?

A: Polyaniline anti-corrosion coating is not a rust-preventive paint.

Rust-preventive paints are applied in mildly corrosive environments with low anti-corrosion requirements. Most of them are single-component primers or combined primer-finish paints, primarily acting by isolating the substrate from atmospheric corrosive media like water and oxygen through barrier and shielding effects to prevent rust.

In contrast, polyaniline anti-corrosion coatings are used in environments with more severe corrosive atmospheres and require a higher anti-corrosion lifespan. They are often part of a "primer-intermediate coat-topcoat" composite coating system.

Q46: How does polyaniline anti-corrosion coating compare to graphene anti-corrosion coating in terms of performance?

A: Graphene itself does not have anti-corrosion properties. Its anti-corrosion performance comes from zinc powder. This anti-corrosion coating is essentially a zinc-rich coating.

Through past zinc-rich coatings, 0.5-0.9% graphene was added to increase zinc powder's conductive channels and improve anti-corrosion performance.

However, graphene is expensive, increasing the cost of anti-corrosion coatings, and its improvement in anti-corrosion performance is limited.

Polyaniline anti-corrosion coatings have significant advantages in terms of comprehensive performance such as anti-corrosion, adhesion, scratch resistance, and price.

Q47: Is the construction method of polyaniline anti-corrosion coating the same as that of zinc-rich coating?

A: The construction method of polyaniline anti-corrosion coating is the same as that of zinc-rich coating. For details, please refer to the technical standards of JT/T 722-2026 "Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures."

Q48: For complex structures (such as welds, edges), which coating provides better protection?

A: Polyaniline coatings have excellent edge protection properties, avoiding the problem of thinning coatings at corners due to the "edge effect" common in traditional zinc-rich coatings.

Q49: What are the advantages of polyaniline anti-corrosion coating for steel structure maintenance and repair?

A: Large-scale maintenance and repair of steel structures are usually carried out on-site and require the old coating to be completely and cleanly removed, with rust removal reaching Sa2.5 or Sa3.0 grade.

However, due to site and time constraints, this is difficult to achieve, making maintenance very challenging.

Polyaniline anti-corrosion coatings have high adhesion and can be applied even at a rust removal grade of Sa2.0, significantly reducing maintenance difficulty and ensuring good maintenance results.

PART 3: MARKET

Q50: What is the market size of polyaniline anti-corrosion coatings?

A: China's heavy-duty anti-corrosion coatings exceeded 4.6 million tons in 2025, with a market size of over 180 billion yuan.

Currently, the heavy-duty anti-corrosion coatings industry is undergoing a transformation from "quantity" to "quality."

Polyaniline anti-corrosion coatings align with China's development trends of environmental friendliness and high performance, possessing broad market prospects.

Q51: What is the development status of polyaniline anti-corrosion coatings at home and abroad?

A: As early as 1999, the German company Oumingchuang Chemical Company developed the anti-corrosion of marine polyaniline series of products named Corrpassive. The United States, Japan and other countries have also researched related polyaniline preservative products, but the production scale is relatively small.

In China, Hunan Ben An Ya Da New Materials Co., Ltd. cooperated with Changchun Institute of Applied Chemistry, Chinese Academy of Sciences for more than 20 years, and pioneered the world's first 10,000-ton polyaniline anti-corrosion coating production line.

Production of polyaniline anti-corrosion coating products has been widely used in Chinese bridges, highways, airport terminals and many major projects involving people's livelihood.

Q52: What is the customer acceptance of polyaniline coatings?

A: Verification of anti-corrosion for steel structures is a long process, especially for polyaniline anti-corrosion coatings as a brand-new anti-corrosion technology.

After more than twenty years of actual anti-corrosion engineering verification, and with the tightening of environmental regulations and the increasing demand for long-term anti-corrosion, more and more customers are gradually accepting polyaniline anti-corrosion coatings and actively seeking polyaniline anti-corrosion solutions. In recent years, offshore infrastructure facilities like wind power, marine engineering, cross-sea have been using polyaniline as anti-corrosion solutions.

Q53: What are the main competing products of polyaniline coatings currently?

A: The status of zinc-rich primers as anti-corrosion coatings is undeniable. This coating remains the main competitor to polyaniline anti-corrosion coatings. There appears a situation where both types of products coexist will occur in the next 3-5 years.

As polyaniline anti-corrosion coatings become increasingly known in the industry and their performance is understood, they will gradually replace zinc-rich primers, and their usage will increase rapidly.

Q54: Which industries have a fast-growing demand for polyaniline coatings?

A: Polyaniline anti-corrosion coatings have excellent environments, marine atmospheric environments, and high and low-temperature environments, capable of withstanding anti-corrosion requirements under extreme conditions, while traditional anti-corrosion coatings have relatively poor durability.

Based on performance edges, polyaniline anti-corrosion coatings have been growing rapidly in applications among projects exposed to adverse environment conditions like sea bridges, ocean engineering, oil extraction and petrochemical refining, new energy (solar power, wind power) etc.

Q55: What is the export market potential of polyaniline anti-corrosion coatings?

A: China has formed a complete and mature industry chain for polyaniline anti-corrosion coatings, from production and engineering anti-corrosion design to application.

The international market has a strong demand for environmentally friendly anti-corrosion materials.

Due to their environmentally friendly nature without heavy metals, polyaniline coatings have enormous export market potential.

Q56: What application fields can polyaniline anti-corrosion coatings be applied to?

A: The application fields of polyaniline anti-corrosion coatings include metal anti-corrosion and concrete anti-corrosion.

Metal anti-corrosion is not limited to steel, but also provides efficient anti-corrosion for most metals and alloys such as zinc, aluminium, magnesium, and copper. They also exhibit excellent anti-corrosion effects for concrete components.

Polyaniline anti-corrosion coatings possess excellent cathodic delamination resistance, demonstrating superior comprehensive anti-corrosion performance in marine environments and harsh corrosive conditions.

Application fields include, but are not limited to, bridges, tunnels, highways, airport terminals, marine engineering equipment, and wind power, covering various international livelihood sectors.

Q57: In bridge engineering, which parts are suitable for polyaniline coatings?

A: Polyaniline anti-corrosion coatings are suitable for all contact surfaces of bridge steel structures, including exposed bridge surfaces, inner surfaces of box girders, undersides of bridge decks, top surfaces of uncovered steel bridge decks, top surfaces of covered steel bridge decks, and unenclosed inner surfaces of box girders.

Q58: What are the advantages of polyaniline anti-corrosion coatings in cross-sea bridges?

A: Cross-sea bridges are located in harsh environments and have high environmental protection requirements.

Polyaniline anti-corrosion coatings have significant advantages in the construction and maintenance of such bridges.

Polyaniline anti-corrosion coatings do not contain any heavy metals and are environmentally friendly, causing no pollution to oceans or rivers during the bridge's construction or subsequent on-site maintenance.

More importantly, polyaniline anti-corrosion coatings offer excellent anti-corrosion performance, outstanding resistance to acid, alkali, and salt, and can achieve long-term anti-corrosion effects for cross-sea bridges.

Q59: Can polyaniline coatings be used for the piers of cross-sea bridges?

A: The piers of cross-sea bridges are constantly exposed to high salt and wave impact environments. Regardless of whether they are stainless steel, alloys, or cement, they are highly susceptible to corrosion and powdering, making them "severely affected" areas.

Polyaniline coatings have excellent saltwater resistance, effectively preventing chloride ion erosion and providing very good anti-corrosion effects for bridge piers.

Q60: Can polyaniline anti-corrosion coatings be used for anti-corrosion coating of offshore wind power equipment?

A: Wind turbine towers and blades are exposed to the marine atmospheric environment, which is not only highly corrosive but also difficult to maintain and repair, often requiring high-altitude operations, significantly increasing later operational costs.

Polyaniline anti-corrosion coatings can resist high-humidity, high-salt marine atmospheric environments and provide excellent anti-corrosion performance for offshore wind power equipment, not only improving anti-corrosion effectiveness but also greatly reducing later maintenance costs.

Q61: Can polyaniline anti-corrosion coatings be used for anti-corrosion of unmanned surface vessels?

A: Unmanned surface vessels are primarily made of aluminium alloy. Zinc-rich primers do not provide anti-corrosion for this type of material, whereas polyaniline anti-corrosion coatings offer excellent anti-corrosion properties for aluminium alloys, meeting stringent anti-corrosion requirements.

Q62. Can polyaniline be applied to offshore equipment facilities; cross-sea bridges and tunnels?

A: Offshore equipment facilities and cross-sea bridges and tunnels are long-term exposed to high-salt, high-humidity, and harsh marine corrosive environments, where short anti-corrosion lifespan is a "pain point" for the entire industry.

Polyaniline anti-corrosion coatings have excellent high-temperature, high-humidity, and high-salt resistance, capable of meeting the anti-corrosion performance requirements under these severe working conditions and ensuring long-term anti-corrosion performance of related equipment.

Q63: Corrosion is severe on steel and concrete structures in ports and docks. Can polyaniline anti-corrosion coatings provide effective anti-corrosion?

A: Ports and docks are constantly exposed to high-salt, high-humidity, and strong ultra-violet radiation environments, making related equipment highly susceptible to corrosion. This requires anti-corrosion coatings with excellent salt resistance.

Polyaniline anti-corrosion coatings have excellent blocking effects on chloride ion penetration, providing superior anti-corrosion performance.

Furthermore, when combined with polyaniline anti-corrosion intermediate coats and fluorocarbon topcoats, they form a composite coating that can effectively address anti-corrosion and UV aging resistance.

Q64: Polyaniline anti-corrosion coatings are used for ship anti-corrosion, compared with zinc-rich paints….. Why?

A: The German company Oumingchuang Chemical Company launched the Corrpassive series as early as 1994. Listed products, dedicated to anti-corrosion in the field of ships, it turns out that polyaniline anti-corrosion coatings are on ships….The anti-corrosion life on the ship is 5 times that of traditional anti-corrosion zinc-rich paint.

Q65: Why is the ballast tank of a ship particularly suitable for polyaniline coating?

A: The environment of the ballast tank is airtight, alternating dry and wet, and the seawater is highly corrosive, which is the "rot" of the ship. Eclipse the hardest hit area".

Polyaniline coatings are known for their excellent resistance to water, salt, and chemicals and moisture and heat resistance, which can effectively prolong the anti-corrosion performance of equipment in this area.

Q66: What is the application effect of polyaniline coatings in the field of highway guardrails?

A: The highway corrugated guardrail is in the JC3-JC4 atmospheric environment, and the polyaniline anti-corrosion coating is complete. It can meet the anti-corrosion performance requirements of highway guardrails and increase the anti-corrosion performance by 3 times above.

Q67: Questions about the corrosion and diseases of road and bridge concrete in alpine areas. Question, what are the advantages of polyaniline anti-corrosion coatings?

A: Concrete components of highways and bridges in alpine regions will appear. One of the more serious diseases is that the region is scattered in winter. A large amount of chloride ions in the snowmelt salt of the pavement passes through the concrete. The hole-structure, immersed in the internal structure of the concrete, accelerates a lot. The saturation of the water in the hole, under the action of freeze-thaw, the expansion of the water and shrinkage cause damage to the concrete structure.

Another major reason is: The chloride ions of the snowmelt salt immersed in the cement will be in the concrete. Steel components suffer from "pitting corrosion," causing concrete to corrode rapidly from the inside out.

Polyaniline anti-corrosion coating has excellent ability to prevent the damage caused by chloride-ion-induced pitting corrosion. Moreover, polyaniline penetrates into the reinforcing steel in porous cement, providing good anti-corrosion protection for embedded steel components.

Thus, polyaniline anti-corrosion coating can solve the corrosion problems of road and bridge concrete components in high-cold and high-salt areas, including bridge expansion joints, drainage holes, and anti-collision walls.

Q68: Can polyaniline anti-corrosion coating be applied to railway carriage anti-corrosion?

A: Most railway carriages are made of iron, aluminium, magnesium, and their alloys.

Polyaniline anti-corrosion coating has excellent anti-corrosion performance for these metals, especially for aluminium-magnesium alloys, with outstanding adhesion. This ensures

no risk of paint peeling during high-speed train operation, which is very valuable for improving railway operation safety and reducing life-cycle costs.

Q69: Can polyaniline anti-corrosion coating be used for steel structures in thermal power plants, storage tanks and pipelines in petrochemical plants, etc.?

A: Yes, polyaniline anti-corrosion coating can be fully used.

Thermal power plants and chemical plants are exposed to acidic or alkaline industrial atmospheres year-round, causing severe corrosion of steel components.

Polyaniline anti-corrosion coating has excellent chemical resistance. It provides good anti-corrosion protection for steel components in this field and offers long-term protection.

Q70: Can polyaniline anti-corrosion coating be used for water pipes, natural gas pipes, sewage pipes, especially buried pipelines?

A: Yes, polyaniline anti-corrosion coating can be fully used. Its excellent environmental tolerance ensures that the polyaniline anti-corrosion coating provides good anti-corrosion performance for steel components in the complex environment of buried pipelines, achieving long service life of the pipes.

Q71: What are the advantages of polyaniline anti-corrosion coating for anti-corrosion of large steel structures such as airport terminals and stadiums?

A: These large construction projects require good anti-corrosion durability, aesthetics, and especially high fire resistance and environmental performance.

Polyaniline anti-corrosion coating has good anti-corrosion performance and excellent compatibility with fire-retardant coatings and topcoats. It has passed strict toxicity tests and fully complies with relevant standards. There are already many construction cases of such projects.

Q72: Can polyaniline coating provide protection for equipment long exposed outdoors, such as high-voltage transmission towers and photovoltaic brackets?

A: High-voltage transmission towers and photovoltaic brackets made of aluminium alloy, stainless steel, galvanized steel, concrete, etc., are exposed to strong UV radiation, sandstorms, and industrial atmospheres year-round.

A composite coating system using polyaniline anti-corrosion coating as primer, polyaniline epoxy intermediate coat, and fluorocarbon topcoat can solve the anti-corrosion and aging problems of these long-term outdoor environments.

Q73: Can polyaniline anti-corrosion coating be used for construction machinery such as excavators and cranes?

A: Yes, polyaniline anti-corrosion coating can be fully used.

Polyaniline anti-corrosion coating has the advantages of scratch resistance, vibration resistance, and long anti-corrosion life, which can reduce the maintenance frequency of outdoor operation equipment and lower usage costs.

Q74: Can polyaniline anti-corrosion coating be applied to highway corrugated guardrails?

A: Polyaniline powder coating can be applied to highway corrugated guardrails for anti-corrosion. There are already relevant construction cases, and the related technology has been reflected in the industry standard JT/T 600-2025 "Anti-corrosion Powder Coating and Coating for Highway Use."

For maintenance and repair of corrugated guardrails, high-solids polyaniline anti-corrosion coating can be used to meet on-site construction requirements with more convenient application.

For specific construction, refer to the technical standards of JT/T 722-2026 "Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures."

Q75: Can polyaniline coating be used for hydraulic steel gates (e.g., reservoirs, hydropower stations)?

A: The corrosive environment for hydraulic steel gates is much milder than the marine corrosive environment.

Polyaniline anti-corrosion coating can fully meet the anti-corrosion requirements of equipment in this environment and provides good anti-corrosion effects for hydraulic steel gates.

Q76: Can polyaniline anti-corrosion coating be used for containers?

A: Yes, waterborne polyaniline anti-corrosion coating can be used and fully meets the anti-corrosion performance requirements for containers.

PART 4: PRACTICAL GUIDE

Q77: How to distinguish genuine polyaniline coating from fake?

A: Test according to the technical standards for polyaniline anti-corrosion coatings in JT/T 722-2026 "Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures."

If all index requirements are met, it is genuine polyaniline anti-corrosion coating; otherwise, it is counterfeit or substandard.

Q78: How to construct polyaniline anti-corrosion coating?

A: The construction method for polyaniline anti-corrosion coating is the same as that of traditional zinc-rich paint. Specific construction shall be implemented according to the relevant technical content in JT/T 722-2026 "Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures."

Q79: Is there a matching thinner for polyaniline anti-corrosion coating?

A: Yes. It is recommended to use the special thinner provided by the polyaniline anti-corrosion coating manufacturer to ensure good construction performance and coating effect.

Q80: Is there a relationship between the film thickness of polyaniline anti-corrosion coating and the anti-corrosion lifespan?

A: There is a certain relationship. A recommended film thickness of about 60-80 μm can achieve an anti-corrosion life of over 30 years. It is recommended to spray two coats to avoid sagging caused by one overly thick coat.

Q81: What are the environmental requirements for polyaniline anti-corrosion coating construction?

A: Polyaniline anti-corrosion construction has no special environmental requirements, similar to those for zinc-rich paint.

Construction environment temperature: 5°C to 38°C, relative air humidity not greater than 85%, steel surface temperature at least 3°C above dew point.

Outdoor construction is prohibited under rain, fog, snow, strong wind, and heavy dust conditions. When the ambient temperature is between -5°C and 5°C, low-temperature curing polyaniline anti-corrosion coating products should be used.

Q82: What is the recoat interval for polyaniline anti-corrosion coating? What to do if the maximum recoat interval is exceeded?

A: At an ambient temperature of 25°C, the minimum recoat interval for polyaniline anti-corrosion coating is 6 hours. If the ambient temperature is above 25°C, the interval can be appropriately shortened; below 25°C, it can be appropriately extended.

The maximum recoat interval is 10 days. If the maximum recoat interval is exceeded, the paint film must be roughened (e.g., by sanding) to ensure interlayer adhesion.

Q83: What is the construction efficiency of polyaniline coating? How long does it take to dry?

A: Odorless, spray volume 1.5-3 L/min, high efficiency for large areas. At 25°C, surface dry in about 2 hours, hard dry in 12 hours.

Q84: After mixing the two components of polyaniline anti-corrosion coating, what is the pot life?

A: At 25°C, the pot life of the two mixed components is 3-4 hours. Higher temperature shortens the time, lower temperature prolongs it slightly.

Q85: Can polyaniline anti-corrosion coating be used alone as a primer?

A: Yes. In enclosed situations or where no special requirements for light aging exist, polyaniline anti-corrosion coating can be used alone as a primer.

Under extreme working conditions, long-term outdoor light exposure, or color requirements for the coating appearance, an intermediate coat and topcoat should be applied over the polyaniline anti-corrosion primer according to actual conditions.

Q86: What requirements does polyaniline anti-corrosion coating have for intermediate and topcoats?

A: Polyaniline anti-corrosion coating has no special requirements for intermediate and topcoats; both solvent-borne and waterborne systems are acceptable.

However, before matching, interlayer adhesion performance testing should be carried out. The polyaniline anti-corrosion coating manufacturer provides matching intermediate and topcoats.

Q87: During construction of polyaniline anti-corrosion coating, how to avoid thinning of coating at edges and corners caused by the "edge effect"?

A: Pre-coat the edges, corners, welds, bolts, and other parts of the steel structure by brush or roller before spraying to ensure the coating thickness at weak areas meets the requirement, following the "90-10" film thickness principle.

Q88: Under what circumstances does polyaniline anti-corrosion coating require maintenance and repair? How to perform repair and recoating?

A: Whether the paint film needs repair is evaluated according to GB/T 1766 and GB/T 30789.3. Repair or recoating shall be carried out according to Appendix H of JT/T 722-2026 "Technical Conditions for Anti-corrosion Coating of Highway Bridge Steel Structures."

Q89: How to repair damaged polyaniline anti-corrosion coating?

A: Grind and clean the damaged area to expose metal or intact coating, then recoat with polyaniline anti-corrosion primer, intermediate coat, and topcoat according to the film thickness of the new anti-corrosion coating.

Q90: What are the requirements for cleaning construction equipment?

A: After construction, all pipes and equipment should be cleaned. Usually, use special thinner promptly to clean the nozzle, pipes, and other parts that came into contact with the coating and equipment, to avoid affecting the next use.

Q91: Does the use of polyaniline anti-corrosion coating affect the environment?

A: Polyaniline anti-corrosion coating does not contain toxic or harmful heavy metals, does not pollute the surrounding groundwater or atmospheric environment, and its volatile organic compound (VOC) content complies with relevant standards. It is a green and environmentally friendly anti-corrosion coating.

Q92: Will polyaniline agglomerate during storage of polyaniline anti-corrosion coating?

A: The technical problems of polyaniline dispersion and agglomeration have been solved. Within the shelf life, polyaniline will not agglomerate.

Q93: Can polyaniline anti-corrosion coating be fast-curing? How is the anti-corrosion performance?

A: UV-curable polyaniline anti-corrosion coating can achieve fast curing, instant curing under UV light. Limited by the coating thickness (UV penetration depth of 30-35 μm), this type of polyaniline anti-corrosion coating can be used for short-term anti-corrosion of 1-2 years, such as temporary anti-corrosion for steel pipes and color steel sheets.

Q94: What are the advantages of polyaniline anti-corrosion coating in road and bridge engineering applications?

A: Roads and bridges are major national engineering projects, and high-quality anti-corrosion is of utmost importance.

The ultra-long anti-corrosion durability of over 30 years provided by polyaniline anti-corrosion is an important guarantee for the anti-corrosion quality of roads and bridges.

Moreover, the low density of polyaniline anti-corrosion coating can reduce the weight of roads and bridges by 40%, lowering the load on bridges and ensuring safer operation.

In addition, the high adhesion and scratch resistance of polyaniline anti-corrosion coating effectively ensure the weatherability of the paint film, offering greater practical value for subsequent maintenance and repair.

Q95: What are the advantages of polyaniline anti-corrosion coating for maintenance of major steel structure projects?

A: Major engineering projects represented by bridges and highways in China have gradually entered a high-incidence period of maintenance and repair. Simple and efficient maintenance processes will not seriously affect the normal operation of related facilities.

Polyaniline anti-corrosion coating can be applied even when the steel substrate and old paint film are not completely cleaned. Its excellent low-surface-preparation application performance and high adhesion can greatly simplify the difficulty of repair and improve coating efficiency.

Q96: Is the supply of polyaniline anti-corrosion coating stable?

A: The polyaniline anti-corrosion coating industry chain is fully independently controllable.

Aniline, the main raw material for polyaniline anti-corrosion coating, has a domestic production capacity of 5 million tons, ensuring sufficient raw material supply that will not restrict the development of the polyaniline anti-corrosion coating industry.

Q97: Is the polyaniline anti-corrosion coating film formed by polyaniline itself?

A: As a polymer material, polyaniline itself can form a film, but the film-forming substance in the anti-corrosion coating is not polyaniline but the polymer film-forming resins such as epoxy resin, polyurethane resin, acrylate resin, and polyvinyl chloride resin in the anti-corrosion coating.

Polyaniline is dispersed in these resins.

Q98: Is the polyaniline anti-corrosion coating conductive?

A: Polyaniline anti-corrosion coating is not conductive. Its anti-corrosion relies on the redox properties of polyaniline, not electrical conductivity.

Q99: What are the market competitive advantages of polyaniline anti-corrosion coating?

A: Polyaniline anti-corrosion coating has advantages such as long-lasting anti-corrosion performance, simple and fast maintenance performance, and excellent scratch resistance. At the same time, it has lower coating cost per unit area, giving it excellent cost-performance and strong market competitive advantages.

Q100: What are the development prospects of waterborne polyaniline anti-corrosion coating and UV-curable polyaniline anti-corrosion coating?

A: Waterborne polyaniline anti-corrosion coating can achieve anti-corrosion performance of more than 5 years, and there are many practical application cases in C1-C4 atmospheric environments.

Compared with high-solids polyaniline anti-corrosion coating, waterborne polyaniline anti-corrosion coating is more environmentally friendly.

However, currently, it cannot achieve long-term anti-corrosion performance in extreme working conditions or marine environments.

The advantage of UV-curable polyaniline anti-corrosion coating is fast curing, but because thick film coating is not possible, it can be used for temporary anti-corrosion of transported steel, with an anti-corrosion life of about 1-2 years.

These two types of polyaniline anti-corrosion coatings can be used in fields with lower anti-corrosion requirements and have great application prospects. They can also be used together with high-solids polyaniline anti-corrosion coating to achieve anti-corrosion goals for steel structures under different working conditions.

"The China Is Reshaping the Global Anti-corrosion Landscape"