Product Introduction

For zinc plating and zinc alloy plating
Trivalent Chromium Passivation Agent Tryner Series

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Introduction

Since steel members are inexpensive and easy to process, they are used in various fields including automobiles, electric products, building materials, etc. However, untreated steel members are susceptible to rust and cannot maintain aesthetics and mechanical strength for a long period of time. Therefore, it is common for steel members to be subjected to rust prevention treatment.

Zinc plating is widely used as a typical rust prevention treatment for steel because it has a "sacrificial protection" effect to suppress corrosion of steel members by preferential corrosion of zinc, which has a larger ionization tendency than steel in a corrosive environment.

Zinc exhibits excellent anticorrosive effect on steel, while zinc itself is easily corroded, so appearance is impaired in a short period in the case of only by zinc plating the steel member. In addition, if the corrosion of zinc proceeds and disappears from the surface of the steel member, the " sacrificial protection" effect is also lost at the same time.[1] Therefore, it is necessary to protect the zinc plating film itself, a representative means is "chemical conversion film treatment". In the past, "chromate treatment" using hexavalent chromium was used, but the use of hexavalent chromium was regulated by the ELV Directive[*1], which was implemented in 2000, and RoHS Directive[*2], which was implemented in 2006. In recent years, "chromate treatment" has shifted to "trivalent chromium passivation", which does not use hexavalent chromium. "Trivalent chromium

Table 1: Lineup of Tryner

Product name	Plating type	Treatment appearance	Features
Tryner TR-160 Series	Zinc plating	Blue iridescent color	Organic acid-free, uniform blue appearance
Tryner TR-162 Series			Organic acid type, good impure metal resistance
Tryner TR-173 Series		White to yellow iridescent color	Organic acid type, easy to manage
Tryner TR-175 Series			Inorganic silica type, outstanding red rust resistance
Tryner TR-177			Easy wastewater treatment
Tryner TR-184 Series		Black	For rack plating
Tryner TR-185 Series			For barrel plating
Tryner TR-186 Series			For barrel plating, high rust prevention specification
Tryner TR-187 Series			For rack plating, cobalt-free
Triner TRN-988 Series	Zinc-nickel alloy plating	Blue iridescent color	Highest corrosion resistance among zinc-based plating
JASCO 5W115 Series		Black	Adapted for high-nickel eutectoid baths.
Tryner TRF-930	Zinc-iron alloy plating	White to yellow iridescent color	Organic acid type
Tryner TRF-966 Series		Black	Ideal for JASCO Stronzinc

passivation" is one in which a member which is zinc plating or zinc alloy plating in a treatment liquid containing trivalent chromium is immersed, and a thin film is formed on the plating surface by a chemical reaction. The treatment appearance is roughly classified into "white system" and "black system", and those in which a pale iridescent color film of blue to yellow is obtained are set as a white system, and those in which a black film is obtained are set as a black system. There are two main types of white system, an organic acid type that chelate metal ions in the treatment liquid with an organic acid and inorganic silica type that does not contain an organic acid in the treatment liquid and contains colloidal silica.

We have a lineup of the trivalent chromium passivation agent is optimized according to the plating type, the plating method, the required performance, etc., as a "Tryner" series.

Product Summary

JASCO Tryner series is a trivalent chromium passivation agent for electro-galvanizing/electro-galvanizing alloy plating. Film appearance such as blue iridescent color, white to yellow iridescent color, and black color can be obtained, and it is possible to meet various quality requirements (Table 1).

Features of the Tryner Series

- Hexavalent chromium is not contained.
- A trivalent chromium coating can be formed only by immersion treatment.
- Can accommodate various conditions such as line characteristics.
- It can be managed by concentration analysis, and it is easy to perform automated management.

Treatment process

The processing step of the trivalent chromium passivation is described (Figure 1). Treatment process is different in white and black systems, and post dip treatment is necessary for corrosion resistance stabilization and color tone stabilization in the case of black system.

Mechanisms

The trivalent chromium passivation protects the plating layer of the base by its own barrier effect. However, since the trivalent chromium conversion film is a thin film, microscopic damage due to scratches is unavoidable. Therefore, it has a "self-healing function" in which the film regenerating component held in the film at the time of scratching elutes and repairs the damaged portion. Organic acid type trivalent chromium passivation represented by the Tryner TR-173 series shows excellent self-healing property because the existence of organic acid improves the holding power of the film regeneration component. On the other hand, the inorganic silica type trivalent chromium passivation film represented by the Tryner TR-175 and TR-177 series has a stable and high-rust prevention capability with our proprietary system. The film of the Tryner TR-175 and TR-177 has a two-layer structure in which silicon, oxygen (present as silica) is present in the upper layer, and oxides such as chromium, cobalt, and zinc, and hydroxides are present in the lower layer. It should be noted that a major feature is that such a two-layer structure can be constructed by one dip[2] (Figure 2).

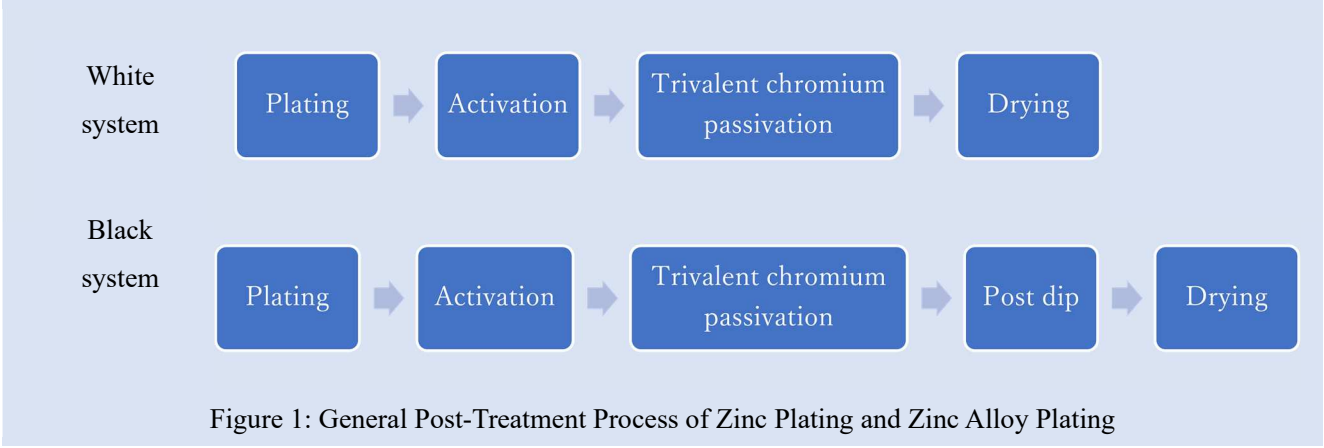

Figure 1: General Post-Treatment Process of Zinc Plating and Zinc Alloy Plating

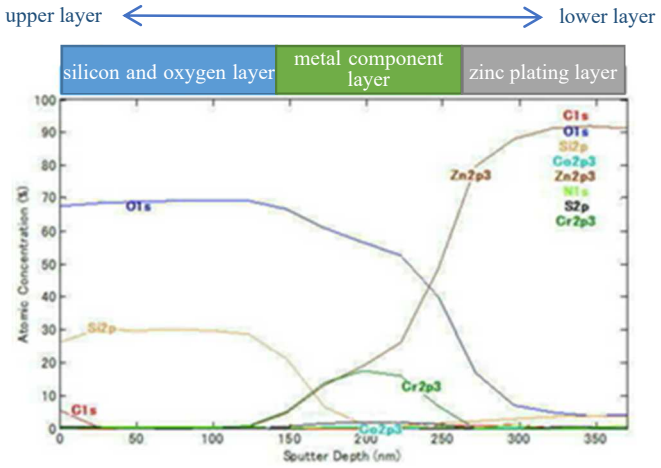

Figure 2: Tryner TR-175 Depth profile by XPS

The silica rich layer of the upper layer is formed by the aggregation of colloidal silica, and this lowers the corrosion rate by dispersing the corrosion current without concentrating on the damaged part. The synergistic effect of this "corrosion current dispersion effect" and the aforementioned "self-healing function" realizes surprising corrosion resistance.

In addition, the trivalent chromium black passivation produces a blackening component during the reaction, and by incorporating it into the film, a black appearance is obtained. Though trivalent chromium black passivation film also has rust prevention mechanism by barrier effect and self-healing function, it is necessary to complement these by post dip treatment because rust prevention power and luster in appearance are deteriorated by the effect of blackening component incorporated into the film.

In closing

JASCO Tryner series offers a lineup of products that can meet all the needs of zinc plating and zinc alloy plating over many years of sales, and is used in a wide range of applications, including automobiles, electrical machinery, and building materials, with excellent performance and manageability.

At present, many trivalent chromium passivation agents contain cobalt to strengthen their self-healing function, but the need for cobalt-free treatment is also increasing due to issues such as REACH regulations[*3], dispute metals, and rare metals, so the cobalt-free treatment agent is also increasing in our lineup.

JASCO Tryner series has evolved through constant research and development and continues to respond to changing market needs.

*1: ELV (End of Life Vehicles) Directive
The EU banned the use of hexavalent chromium, lead, mercury, and cadmium in marketed vehicles after July 1, 2003. As an exception, up to 2 g/unit of hexavalent chromium was permitted until June 2007.

*2: RoHS (Restriction of hazardous Substances) Directive
Electrical and electronic products that will be put on the market in the EU since July 2006 should not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, or polybrominated diphenyl ethers

*3: REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) Regulation
Producers and importers are required to investigate the effects of all chemicals (1 ton/year or more) on humanity and the earth and to apply and register them with the European Chemicals Agency. Furthermore, it is necessary to apply for a permit from the European Chemicals Agency for the use of the regulated substances that have been publicly disclosed and obtain a permit. It entered into force in 2007.

References

1. ELECTROPLATER'S TECHNICAL ASSOCIATION; Gendaimekkikyouhon, first edition 4 printing, p. 371 (2014)
2. Hideo Susa; *J. Surf. Finish. Soc. Jpn.* Vol.70, No. 8, pp. 388-393 (2019)