

Surface Treated Steel Sheets (Electric Appliances)

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Abstract

Surface-treated steel sheet for the purpose of electrical appliances is required corrosion resistance of using the (sacrificed corrosion-protection effect) features of zinc easily corroded than iron in the general environment is a feature of the zinc plating to be a beautiful appearance. In addition, since it is used for products within reach of the consumer, be free of environmentally hazardous substances is also important. We have created products that can contribute to reducing production costs and environmental aspects of customer, “ZINKOTE™” electro-galvanized steel sheet, and “VIEWKOTE™”, “ZINKOTE™ COLOR” pre-coated steel plate that can be omitted in the painting process in the customers.

1. Introduction

As the surface-treated steel sheet for home appliances, a galvanized sheet is often used because zinc helps prevent the corrosion of iron—the base metal—through sacrificial corrosion (sacrificial protective effect). Since zinc is also subject to white rust, it is common to use surface-treated sheet for restraining the occurrence of white rust.

2. Development of Surface-Treated Steel Sheets

2.1 Development of steel sheets for home appliances

In Japan, as home appliances, such as the television (TV), washing machine, and refrigerator, called the “three sacred treasures” of a household, became widespread in the 1970s, followed by audio equipment and the video tape recorder (VTR) in the 1980s (Fig. 1). In the 1990s, the personal computer (PC) and printer for home use became

very popular, and in the 2000s, digital home appliances, such as the flat-panel TV, began spreading rapidly. Steel sheets are used in various parts of these home appliances including the internal mechanisms, chassis, and panels. With the increase in service life of home appliances, steel sheets were required to possess superior corrosion resistance as well as higher strength and formability. Under that condition, chromate steel sheets, which are galvanized sheets subjected to chromate treatment, were widely used in the 1970s. In the 1980s, with the aim of omitting the painting process at the customer end, a fingerprint-resistant steel sheet covered with an organic film was applied even to exposed parts such as the chassis. In the 1990s, chromate-free steel sheets not containing environmentally hazardous substances began to be extensively used. The use of a pre-coated steel sheet that permits omitting the painting process at the customer end has helped promote

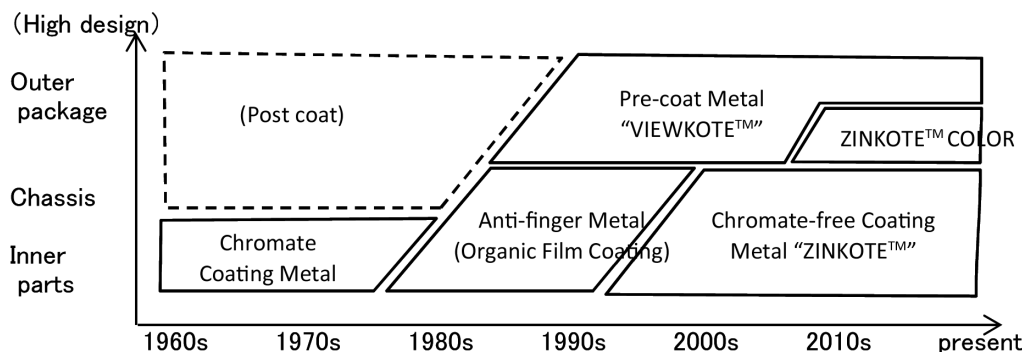


Fig. 1 History of the steel plate as seen in VTR and audio products

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activities to protect the environment and cut the manufacturing costs of home appliances.

2.2 Development of surface treatment

2.2.1 Chromate steel sheet/anti-finger steel sheet

The chromate treatment has long been used for surface treatment of steel sheets. It has been widely used as an inexpensive yet effective method for primary rust prevention of galvanized sheet (keeping the galvanized sheet surface rust-free from the time the sheet is manufactured till the time it is converted into the final product) and for the treatment of substrate. Chromate treatment prevents the galvanized sheet surface from being exposed to corrosive factors such as oxygen and moisture. In addition, even if the coating film surface is damaged, causing the zinc layer to be exposed, the corrosion of zinc is restrained by the self-repairing function of this treatment (Fig. 2). Chromate steel sheet subjected to chromate treatment has been widely used in home appliances. However, in many cases, the chromate sheet for external parts, which are held directly by hand, is used painted since fingerprints tend to stand out on the sheet surface.

Under this condition, a new anti-finger steel sheet having an organic film coated on the chromate-treated surface was developed. Since the newly-developed fingerprint-resistant steel sheet can be used unpainted not only for internal parts but also for external parts, such as the bottom and back panels, it has become possible for customers to omit the painting process.

2.2.2 Development of chromate-free steel sheet

The chromate steel sheet and the anti-finger steel sheet mentioned above contained hexavalent chromium. On the other hand, the demand for a new surface-treated steel sheet without hexavalent chromium—an environmentally hazardous substance—boosted in the 1990s. Nippon Steel & Sumitomo Metal Corporation developed a chromate-free film and successfully commercialized a chromate-free steel sheet ahead of other steelmakers.

To materialize the chromate-free steel sheet, it was considered

necessary to distribute three functions of the chromate film—shutting out corrosive factors, self-repairing layer damage, and securing paintability—to more than one substance other than hexavalent chromium. By adding a corrosion inhibitor having self-repairing capability to the base resin, which is capable of efficiently shutting out corrosive factors and securing paintability, it became possible to develop a chromate-free steel sheet comparable in performance to the chromate steel sheet and fingerprint-resistant steel sheet. Today, as the ZINKOTE™ series of chromate-free steel sheets, “QS1” having both corrosion resistance and electric conductivity, “QF1” with superior corrosion and scratch resistance, and “QM” having improved paintability and electric conductivity are available.

2.3 Progress of pre-coated steel sheets

During the period from the late 1990s to early 2000s, the environmental awareness especially increased not only in the raw materials preparation process but also in the steelmaking process. The use of a pre-coated steel sheets (“VIEWKOTE™”) has made it possible for the customer to restrain the occurrence of volatile organic compounds in the coating process and even omit the degreasing and painting processes. As shown in Fig. 3, the typical pre-coating consists of a primer coat having good adhesion to plating and corrosion resistance, and a decorative top coat. Using its own technology, Nippon Steel & Sumitomo Metal has developed new coating films which are applicable even to steel sheets for home appliances that are required to have higher formability than structural steels.

Recently, the company has developed with “ZINKOTE™ COLOR,” a new product that integrates the two functions of the primer coat and top coat into a single coat to simplify the manufacturing process, thereby cutting the production costs and reducing environmental impact. At present, the product is available in three colors—black, silver, and white. As a product which helps cut the manufacturing costs, the application of ZINKOTE™ COLOR to flat TVs and other home appliances is increasing.

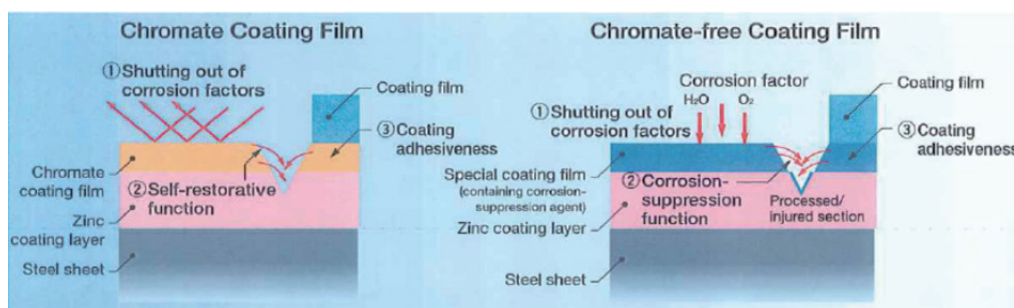


Fig. 2 Corrosion resistance mechanism for conventional chromate treatment and chromate-free coating film

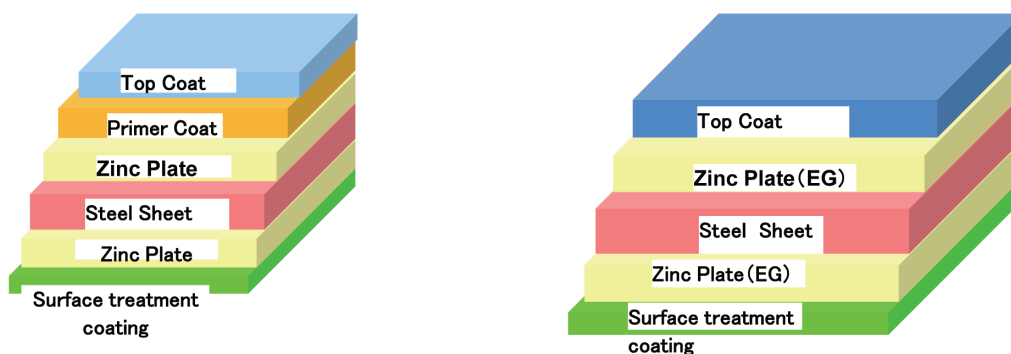


Fig. 3 Structure of pre-coat metal “VIEWKOTE™” and “ZINKOTE™ COLOR”

3. Conclusion

Quick to perceive the customers' needs for environment-friendly steel products having superior corrosion and fingerprint resistance and for streamlining of their processes, Nippon Steel & Sumitomo Metal has developed, ahead of other steelmakers, various new surface-treated steel sheets for home appliances, including ZINKOTE™, VIEWKOTE™, and ZINKOTE™ COLOR.

In the field of home appliances, especially those of digital type, we are required to respond promptly, even to very rapid changes that occur in the field. The company is determined to continue offering the products that the customer really needs, thereby contributing to society.



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