New Film Laminated Steel Sheet for 18L Can and Pail Can

1. Introduction

As the use of lacquer paints containing endocrine disrupters such as bisphenol A has recently been considered a social problem, the need for replacing these lacquers with laminated films has grown for 18L cans and pail cans, the insides of which are still painted with lacquers. An additional merit of using film laminated steel sheets is that can manufacturing costs can be reduced by eliminating the painting process. To meet the needs mentioned above, NKK has lead the development of new coil laminated steel sheets for 18L cans and pail cans that can be used for a wide variety of contents. The outlines are introduced as follows.

2. Outline of new laminated steel sheet for 18L can and pail can

The new laminated steel sheets are laminated with either of two types of plastic films, which use low-cost resins and contain no harmful substances such as bisphenol A and dioxin. This first of these films, (1) PP (polypropylene) film, is chemically stable against acid and alkaline materials. The second type of film, (2) PET (polyethylene terephthalate) film, does not change flavor of food. A wide variety of can maker's needs can be met with the PP and PET type films.

2.1 The PP laminated steel sheet for general use

Fig.1 shows the cross section of the PP laminated steel sheet for general use. The newly designed two layered PP film is heat-laminated on TFS (Tin Free Steel sheet = metallic chromium and chromic oxide electrodeposited on the surface of a steel sheet).



Fig.1 The cross section of PP laminated steel sheet for 18L can and pail can

The upper film layer is homo PP with a high melting point, so that the film should not melt with the heat of baking when lacquer is painted on the outside of the can. However, because homo PP has poor adhesion to TFS, an adhesion layer is inserted between the homo PP layer and TFS.

The adhesion layer contains an optimum ratio of carboxylic acid modified PE (polyethylene) mixed with carboxylic acid modified PP. By adding low melting point PE to PP, this film adheres excellently to TFS due to the resin's high wettability over TFS at the lamination temperature. However, when the PE mixing ratio in the adhesion layer becomes too high, interlayer detachment occurs between the upper homo PP layer and the adhesion layer because of the difference in the resin compositions. **Fig.2** shows the influence of PE mixing ratio in the lower layer on the cross-cut part corrosion resistance and the film adhesion strength.



(1g.2 Influence of PE ratio in adhesion layer on (A) cross-cut part corrosion resistance and (B) film adhesion strength

After the PP laminated steel sheet was cross cut and immersed in a strong alkaline solution for two weeks,

promoting film delamination, the film delamination width was measured at the cross-cut. The adhesion strength of the film was measured by the T-peel method where two test-pieces cut into the width of 5mm were pasted with the two-film side inside.

With the increase of the PE mixing ratio, film delamination width is decreased by the increase of adhesion to TFS and the restriction of diffusion of alkalline solution into the interface. On the other hand, the film peeling strength decreases because of the interlayer detachment between two layers. When the peeling strength is low, the film peels off easily at the seamed part between the can-end and the body, resulting in insufficient pressure resisting strength. Therefore, proper balance of the PE mixing ratio is controlled to satisfy both corrosion resistance and peeling strength.

NKK's PP laminated steel sheet achieves the balance of corrosion resistance and adhesion in high level by controlling the PE mixing ratio in the adhesion layer to the optimum value mentioned-above.

2.2 The PET laminated steel sheet for food container use

Fig.3 shows the cross section of the PET laminated steel sheet for food container use. The biaxially oriented PET-I (isophthalic acid copolymerized PET) film is laminated on TFS. The formability and strength of the film are controlled by the amount of biaxial orientation of the PET-I film. This film shows excellent corrosion resistance to food elements such as organic acids and sulfur containing compounds, therefore it is well suited for food container use.



Fig.3 The PET laminated steel sheet for 18L can and pail can

3. Example of can made from the new laminated steel sheet

Photo 1 shows examples of cans made from NKK's new laminated steel sheets. (A) is an example of 18L welding can made from the PP laminated BRITE WEL (NKK's weldable TFS without grinding). A wide range of acidic and alkaline contents are able to be packed, and the pressure resisting strength exceeds the standard of Hazardous

Materials Safety Techniques Association. (B) is an example of pail can end, laminated with the PP film inside and the white PET film outside, which makes possible clear and colorful printing. The film adhesion is high and the film does not peel off at the drawn circumference of the can end.



(A) 18L welding can



(B) Pail can end Photo 1 Example of cans made from NKK's new laminated steel sheet

4. Conclusion

In advance of the world, NKK has developed the two types of new environmentally friendly and low-cost coil laminated steel sheets for 18L cans and pail cans. The PP type using the originally developed two layered film suitable for a wide range of acidic and alkaline contents, and the PET type using the biaxially oriented PET-I film suitable for food container use.

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