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- **YOKOYA, Hirokazu,**
Nippon Steel Corp. Yawata Works
Kitakyushu City, Fukuoka 804-8501 (JP)
- **HASEGAWA, Kazushige**
Nippon Steel Corp. Yawata Work
Kitakyushu City, Fukuoka 804-8501 (JP)

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(71) Applicant: **NIPPON STEEL CORPORATION**
Tokyo 100-8071 (JP)

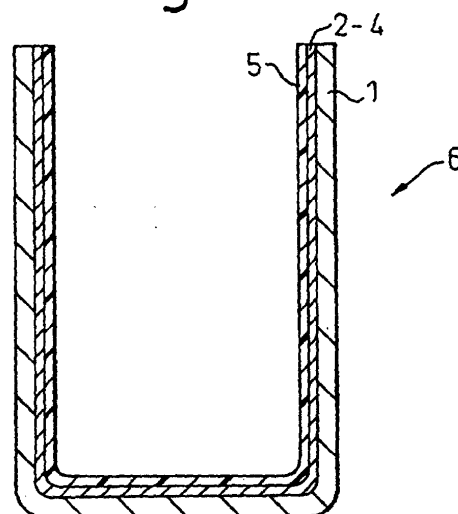
(74) Representative: **VOSSIUS & PARTNER**
Siebertstrasse 4
81675 München (DE)

(72) Inventors:
• **HIRANO, Shigeru,**
Nippon Steel Corp. Yawata Works
Kitakyushu City, Fukuoka 804-8501 (JP)

(54) **STEEL PLATE FOR LAMINATED CONTAINER, AND METHOD FOR PRODUCING CAN USING THE SAME AND CAN**

(57) A steel sheet for a laminated container having excellent canning processability, characterized by having on at least one surface of said steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating made of an organic or inorganic-organic resin having a thickness within a range from 1 to 500 nm, is superior in canning processability and is also superior in film adhesion property, corrosion resistance and weldability. Particularly, a steel sheet for a laminated container, comprising on at least one surface of said steel sheet, in the order of increasing the distance from said steel sheet, a Ni-based plating layer containing Ni in an amount within a range from 5 to 500 mg/m² calculated in terms of the metallic Ni, a Sn-based alloy plating layer, and a dispersed metallic Sn plating layer in an amount within a range from 100 to 1500 mg/m², and further thereon a coating made of phenol-based resin containing a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P with a thickness of 1 - 500 nm. is useful for welding applications.

Fig.3



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Description

TECHNICAL FIELD

[0001] The present invention relates to a steel sheet for a laminated container, as a canning material, which is particularly superior in drawing/ironing processability, weldability, corrosion resistance and a film adhesion property, a method of producing a can using the same, and a can obtained therefrom.

BACKGROUND ART

[0002] Metallic containers for beverages and foods are roughly classified into two-piece cans and three-piece cans. In case of a two-piece can such as a DI can, after the completion of drawing/ironing process, the inside of the can is coated and the outside of the can is coated and printed. In case of a three-piece can, the surface corresponding to the inside of a can is coated and the surface corresponding to the outside of the can is printed, and then the can body portion is welded. In all cans, the coating process is an essential process after or before canning. In the coating process, a solvent-based or water-based coating composition is used and then baking is performed. In this coating process, wastes (e.g. wasted solvent) derived from coating compositions are discharged as industrial wastes and exhaust gases (predominantly carbon dioxide gas) are released into air. For the purpose of global environmental conservation, reducing these industrial wastes and exhaust gases has recently been contemplated. Particularly, a technique of laminating films has attracted special attention in place of coating, and has rapidly propagated.

[0003] In case of the two-piece can, various methods of producing a can with laminated film and inventions related thereto have hitherto been provided. Examples thereof include "Method of producing a drawn/ironed can. (Japanese Patent No. 1571783)", "Drawn/ironed can. (Japanese Patent No. 1670957)", "Method of producing a thin-wall deep-drawn can. (Japanese Unexamined Patent Publication (Kokai) No. 2-263523)", and "Coated steel sheet for drawn/ironed can. (Japanese Patent No. 1601937)".

[0004] Examples of the three-piece can include "Film-laminated steel strip for three-piece can and method of producing the same. (Japanese Unexamined Patent Publication (Kokai) No. 3-236954)", "Steel sheet for three-piece cans having stripe-shaped multi-layer organic coating films. (Japanese Unexamined Patent Publication (Kokai) No. 5-111979)", and "Method of producing a stripe laminated steel sheet for a three-piece can. (Japanese Unexamined Patent Publication (Kokai) No. 5-147181)".

[0005] As the steel sheet used as a substrate for the film of these laminates, for example, a chromate coating obtained by an electrolytic chromate treatment is predominantly used. The chromate coating has a two-layer structure comprising a metallic Cr layer and a hydrated Cr oxide layer formed thereon. Accordingly, a laminating film (an adhesive layer in case of a film with an adhesive) secures the adhesion with a steel sheet via the hydrated Cr oxide layer of the chromate coating. Although details of the mechanism of adhesion have not been made clear, it is considered that the mechanism is based on a hydrogen bond between the hydroxyl group of hydrated Cr oxide and a functional group such as carbonyl or ester group of the laminating film.

[0006] A coating free from electrolytic chromate treatment is disclosed in "A coated metallic material in which an undercoat for film lamination is formed on the surface of the metallic material, and method of producing the same. (Japanese Unexamined Patent Publication (Kokai) No. 10-46101)".

[0007] According to the above inventions, the effect of remarkably advancing global environmental conservation can be certainly obtained. On the other hand, the market of beverage containers is in a state of fierce cost and quality competition with the PET bottles, glass bottles, papers and the like. Consequently, more excellent canning processability, particularly film adhesion property, processed film adhesion properties, corrosion resistance and weldability, are required of the above steel sheets for laminate containers.

[0008] In case of the laminating steel sheet in which the adhesion with a laminating film is secured via the hydrated Cr oxide layer of the chromate coating, the film is damaged by severe processing due to drawing and ironing, thereby deteriorating the film adhesion property and the corrosion resistance after the processing. Therefore, an improvement in the adhesion property of the film at the processed portion is required.

[0009] Also in case of the "A coated metallic material in which an undercoat for film lamination is formed on the surface of the metallic material, and method of producing the same. (Japanese Unexamined Patent Publication (Kokai) No. 10-46101)" as a coating free from the electrolytic chromate treatment, the film is damaged by severe processing due to drawing and ironing and the resulting damaged portion of the film causes drastic deterioration of the corrosion resistance of the processed portion. Therefore, an improvement in film adhesion property and corrosion resistance of the film at the severely processed portion is required.

SUMMARY OF THE INVENTION

[0010] The present inventors have intensively studied a coating utilizing an inorganic or organic resin as a new coating in place of the chromate coat. As a result, the inventors have found that a coating utilizing an inorganic substance or organic resin forms a very strong coherent bond with a laminating film to be applied on the coating, thereby obtaining excellent canning processability as compared with a conventional chromate coating. Thus, the present invention has been completed.

[0011] That is, the present invention provides the following in the first aspect.

(1) A steel sheet for a laminated container having excellent canning processability characterized by having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating made of an organic resin or inorganic-organic resin having a thickness within a range from 1 to 500 nm.

(2) A steel sheet for a laminated container having excellent canning processability characterized by having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating of an organic resin having a thickness within a range from 1 to 500 nm, said organic resin containing one or more of a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P and an organosilicon compound in an amount of not less than 0.1 mg/m² calculated in terms of Si.

(3) A steel sheet for a laminated container having excellent canning processability characterized by having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol resin containing one or more of a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P and an organosilicon compound in an amount of not less than 0.1 mg/m² calculated in terms of Si.

(4) A steel sheet for a laminated container having excellent canning processability characterized by having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating of an inorganic-organic resin having a thickness within a range from 1 to 500 nm, said inorganic-organic resin containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal.

(5) A steel sheet for a laminated container having excellent canning processability characterized by having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol-based resin containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of metal.

(6) A steel sheet for a laminated container having excellent canning processability characterized by having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating of an organic resin having a thickness within a range from 1 to 500 nm, said organic resin containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal and further containing one or more of a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P and an organosilicon compound in an amount of not less than 0.1 mg/m² calculated in terms of Si.

(7) A steel sheet for a laminated container having excellent canning processability characterized by having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol-based resin containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal and further containing one or more of a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P and an organosilicon compound in an amount of not less than 0.1 mg/m² calculated in terms of Si.

(8) The steel sheet for a laminated container of the term (3), (5) or (7), wherein the content of the phenol resin in the coating of the phenol-based resin is not less than 70%.

(9) The steel sheet for a laminated container having excellent canning processability according to any one of

(1) to (8), wherein said surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide comprises Sn in an amount within a range from 80 to 6000 mg/m² calculated in terms of the metallic Sn, Ni in an amount within a range from 10 to 800 mg/m² calculated in terms of the metallic Ni, Fe in an amount within a range from 10 to 800 mg/m² calculated in terms of the metallic Fe, or Cr and hydrated Cr oxide in an amount within a range from 2 to 200 mg/m² calculated in terms of the metallic Cr.

Similarly, in order to attain more improved weldability, film adhesion property and corrosion resistance, the present inventors have intensively studied about a coating utilizing an organic resin as a new coating in place of the chromate coating, formed on a dispersed Sn plating formed on an Ni plating layer, which are in turn formed on the surface of a steel sheet. As a result, they have found that the coating utilizing the organic resin forms a very strong coherent bond with a laminating film to be formed on the coating and also exhibits excellent adhesion property as compared with a conventional chromate coating and that if a chromate-treated layer also exists, more excellent adhesion property and corrosion resistance are attained, thus leading to the invention of the second aspect as preferred embodiment of the present invention.

Therefore, the present invention provides the followings in the second aspect.

(10) A steel sheet for a laminated container, characterized by having, on at least one surface of a steel sheet, in order, a Ni-based plating layer containing Ni in an amount within a range from 5 to 500 mg/m² calculated in terms of the metallic Ni, an Sn-based alloy layer, and a metallic Sn plating layer in an amount within a range from 100 to 1500 mg/m², and further thereon a coating made of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol-based resin containing a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P.

(11) A steel sheet for a laminated container, characterized by having, on at least one surface of a steel sheet, in order, a Ni-based plating layer containing Ni in an amount within a range from 5 to 500 mg/m² calculated in terms of the metallic Ni, an Sn-based alloy layer and a dispersed metallic Sn plating layer in an amount within a range from 100 to 1500 mg/m², and further thereon a coating made of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol-based resin containing a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P.

(12) A steel sheet for a laminated container, characterized by having, on at least one surface of a steel sheet, in order, a Ni-based plating layer containing Ni in an amount within a range from 5 to 500 mg/m² calculated in terms of the metallic Ni, an Sn-based alloy layer, and a dispersed metallic Sn plating layer in an amount within a range from 100 to 1500 mg/m², and further comprising on said dispersed metallic Sn plating layer, a chromate layer in an amount within a range from 4 to 40 g/m² calculated in terms of the metallic Cr, and further thereon a coating made of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol-based resin containing a phosphoric acid-based compound in an amount within a range from 0.1 to 200 mg/m² calculated in terms of P.

(13) A steel sheet for a laminated container, characterized by having, on at least one surface of a steel sheet, in order, a Ni-based plating layer containing Ni in an amount within a range from 5 to 500 mg/m² calculated in terms of the metallic Ni, an Sn-based alloy layers and a dispersed metallic Sn plating layer in an amount within a range from 100 to 1500 mg/m², and further thereon a coating made of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol-based resin containing a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P and further containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal.

(14) A steel sheet for a laminated container, characterized by having, on at least one surface of a steel sheet, in order, a Ni-based plating layer containing Ni in an amount within a range from 5 to 500 mg/m² calculated in terms of the metallic Ni, an Sn-based alloy layer and a dispersed metallic Sn plating layer in an amount within a range from 100 to 1500 mg/m², and further comprising on said dispersed metallic Sn plating layer, a chromate layer in an amount within a range from 4 to 40 g/m² calculated in terms of the metallic Cr, and thereon a coating made of a phenol-based resin having a thickness within a range from 1 to 500 nm, said phenol-based resin containing a phosphoric acid-based compound in an amount within a range from 0.1 mg/m² to 200 mg/m² calculated in terms of P and further containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal.

(15) The steel sheet for a laminated container of any one of (11) to (14), wherein an area ratio of the dispersed Sn is within a range from 40 to 95%.

(16) The steel sheet for a laminated according to (12) or (14), wherein said chromate layer contains at least hydrated Cr oxide in an amount of not less than 2 mg/m² calculated in terms of the metallic Cr.

According to the present invention, there are also provided a method of producing a can using these steel sheets for a laminated container, and a can obtained therefrom.

(17) A method of producing a can using a laminated steel sheet, which comprises producing a can by a drawing or ironing process using said steel sheet for a laminated container of any one of (1) to (9).

(18) A method of producing a can using a laminated steel sheet, which comprises producing a can by a welding process using said steel sheet for a laminated container of any one of (10) to (16).

(19) A can made of a laminated steel sheet, which is produced by a drawing or ironing process using said steel sheet for a laminated container of any one of (1) to (9).

(20) A can made of a laminated steel sheet, comprising a welded portion, using said steel sheet for a laminated

container of any one of (10) to (16).

BRIEF DESCRIPTION OF THE INVENTION

5 **[0012]** Fig. 1 is a schematic sectional view of a steel sheet for a laminated container of the present invention.
[0013] Fig. 2 is a schematic sectional view of another steel sheet for a laminated container of the present invention.
[0014] Fig. 3 is a schematic longitudinal sectional view of a laminated container of the present invention.
[0015] Fig. 4 is a schematic sectional view of a still another steel sheet for a laminated container of the present invention.
10 **[0016]** Fig. 5 is a schematic sectional view of a further steel sheet for a laminated container of the present invention.
[0017] Fig. 6 is a schematic view of another laminated container of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

15 (First aspect)

[0018] The steel sheet for a laminated container as the first aspect of the present invention will be described in detail below.

Substrate

20 **[0019]** The substrate used in the present invention is not specifically limited, and a steel sheet usually used as a material for container is used. The method of producing this substrate and the material thereof are not specifically limited, and the substrate is commonly produced by way of a steel ingot manufacturing process, a hot rolling process,
25 a pickling process, and a cold rolling process.

Surface-treated layer

30 **[0020]** In the first aspect of the present invention, a steel sheet for a laminated container, which is superior in canning processability and is also superior in weldability, corrosion resistance and film adhesion properties, can be obtained by providing a surface-treatment layer containing Sn, Ni, Fe, Cr and hydrated Cr oxide on the substrate sheet.

[0021] The method of forming the surface-treatment layer containing Sn, Ni, Fe, Cr and hydrated Cr oxide on the substrate is not specifically limited. For example, known techniques such as electroplating method, vacuum deposition method and sputtering method may be used and a heat treatment for forming a diffusion layer may also be used in
35 combination.

[0022] The surface-treatment layer containing Sn, Ni, Fe, Cr and hydrated Cr oxide thus formed preferably contains Sn in the amount within a range from 80 to 6000 mg/m² calculated in terms of metallic Sn, Ni in the amount within a range from 10 to 800 mg/m² calculated in terms of metallic Ni, Fe in the amount within a range from 10 to 800 mg/m² calculated in terms of metallic Fe, and Cr and hydrated Cr oxide in the amount within a range from 2 to 200 mg/m²
40 calculated in terms of metallic Cr.

Sn layer

45 **[0023]** Sn exhibits excellent processability and weldability. If severe processing (e.g. drawing, ironing, etc.) must be preformed to reduce the thickness of the sheet to not more than half or to not more than one-third, the Sn layer can impart excellent properties, which is preferred. This effect is particularly remarkable when the Sn layer alone is formed, but is also exerted even in combination with an other plating layer in view of other properties. To exert this effect, the amount of Sn deposited is preferably not less than 80 mg/m² calculated in terms of metallic Sn. To secure the weldability, the amount of Sn is not less than 200 mg/m², and to secure a sufficient processability, the amount is more preferably
50 not less than 1000 mg/m². With the increase in the amount of Sn, the effect of improving the processability and weldability of Sn is enhanced. However, if the amount is 6000 mg/m² or more, the improving effect is saturated and it is economically disadvantageous. Accordingly, the amount of Sn is preferably not more than 6000 mg/m² calculated in terms of metallic Sn.

Ni, Fe layer

55 **[0024]** Ni and Fe exhibit their effects in the film adhesion properties, corrosion resistance and weldability. To exert these effects, it is preferred that Ni or Fe is deposited in the amount of not less than 10 mg/m² calculated in terms of

metallic Ni or Fe. With the increase in the amount of Ni or Fe, the effect of improving the film adhesion properties, corrosion resistance and weldability of Ni or Fe is enhanced. However, if the amount is 800 mg/m² or more, the improving effect is saturated and it is economically disadvantageous. Accordingly, the amount of Ni or Fe is preferably not less than 10 mg/m² and not more than 800 mg/m² calculated in terms of metallic Ni or Fe.

Cr and hydrated Cr oxide layer

[0025] It is preferred that Cr and hydrated Cr oxide, which exert excellent film adhesion properties and corrosion resistance, are contained in an amount within a range from 2 to 200 mg/m² calculated in terms of metallic Cr. If the amount of Cr and hydrated Cr oxide deposited is not more than 2 mg/m² calculated in terms of metallic Cr, adhesion properties are poor. Accordingly, the amount of Cr and hydrated Cr oxide is preferably not less than 2 mg/m² calculated in terms of metallic Cr. As the amount of Cr and hydrated Cr oxide increases, the effect of improving the film adhesion properties and corrosion resistance is correspondingly enhanced. However, if the amount exceeds 200 mg/m², the weldability tends to be deteriorated. Therefore, the amount of Cr and hydrated Cr oxide is preferably not more than 200 mg/m² calculated in terms of metallic Cr.

Organic resin or inorganic-organic resin layer

[0026] After forming a surface-treatment layer containing at least one of Sn, Ni, Fe, Cr and hydrated Cr oxide on the substrate, an organic resin or inorganic-organic resin is provided as an essential feature of the present invention. A steel sheet for a laminated container, which is superior in canning processability to the prior art and is particularly superior in film adhesion properties, processed film adhesion properties and corrosion resistance, can be obtained by providing the organic resin or inorganic-organic resin in combination with the surface-treatment layer containing at least one of Sn, Ni, Fe, Cr and hydrated Cr oxide.

Organic resin layer

[0027] The organic resin coating formed in the present invention exerts an effect of forming a coherent bond with the film laminated or an adhesive layer thereof, thereby to secure high adhesion properties, as described above. Examples of the resin capable of obtaining this effect include epoxy-based resin, phenol-based resin, urethane-based resin, vinyl-based resin, ester-based resin, and styrene-based resin. Among these resins, a phenol-based resin exerts particularly excellent performances. The phenol-based resin can be prepared by a conventional method and is prepared, for example, by polycondensation of a phenol compound, a naphthol compound or bisphenols and formaldehyde.

[0028] The organic resin of the present invention exerts its effect even when mixed with various resins, but preferably contains the content of a phenol resin in an amount of not less than 70% to exert the excellent properties of the phenol-based resin.

Inorganic-organic resin layer

[0029] An inorganic compound contained in this resin has an effect capable of remarkably improving the film adhesion properties and corrosion resistance. Examples of the inorganic compound include phosphoric acid-based compound, organosilicon compounds, sulfuric acid-based compounds, halogen compounds, chloric acid-based compounds, and nitric acid-based compounds. Among these compounds, phosphoric acid-based compounds and organosilicon compounds exert particularly high effects of improving the film adhesion properties and corrosion resistance.

Phosphoric acid-based compound and organosilicon compound

[0030] Examples of the phosphoric compounds having this improving effect include phosphoric acid or salts thereof, condensed phosphoric acid or salts thereof, zirconium phosphate, and titanium phosphate. Examples of the salts include ammonium salt, alkali metal salts such as sodium salt and potassium salt.

[0031] Examples of the organosilicon compound include vinylethoxysilane, aminopropyltriethoxysilane, mercaptopropyltrimethoxysilane, methacryloxypropyltriethoxysilane, and γ -glycidoxypentyltrimethoxysilane.

[0032] The presence of one or more of the phosphoric acid-based compounds or organosilicon compounds exerts a remarkable improvement in film adhesion properties and corrosion resistance. To exert the effect, the phosphoric acid-based compound preferably exists in an amount of not less than 0.1 mg/m² calculated in terms of P and the organosilicon compound preferably exists in an amount of not less than 0.1 mg/m² calculated in terms of Si. However, if the content of the phosphoric acid compound or organosilicon compound in the resin increases, it is economically

disadvantageous. Therefore, the content of the phosphoric acid-based compound or organosilicon compound is preferably adjusted to not more than 200 mg/m² calculated in terms of P or Si.

Ti or Zr compound

[0033] In the present invention, more excellent film adhesion properties and corrosion resistance can be exhibited by incorporating Ti or Zr or one or more compounds thereof into the inorganic-organic resin. The effect of the present invention is not lost even if Ti or Zr is bonded with P or S in the coating. The content of Ti or Zr or one or more compounds thereof in the inorganic-organic resin is preferably within a range from 0.2 to 300 mg/m² calculated in terms of Ti or Zr. If the content of Ti or Zn is smaller than 0.2 mg/m², the effect of improving the film adhesion properties and corrosion resistance is small. On the other hand, if the content exceeds 300 mg/m², it becomes economically disadvantageous. Therefore, the content of Ti or Zr or one or more compounds thereof in the inorganic-organic resin is preferably within a range from 0.2 to 300 mg/m² calculated in terms of Ti or Zr.

[0034] The method of incorporating one or more of Ti or Zr or compounds thereof into the inorganic-organic resin is not specifically limited. The method can be performed by incorporating a Ti compound or a Zr compound into a treating solution described below and dipping a steel sheet in the treating solution. The Ti compound is not specifically limited, but a Ti salt is preferred in view of practical use or performances. Examples of the Ti salt include titanium phosphate, titanium hydrofluoric acid and lithium, sodium, ammonium and other salts thereof, titanium sulfate, and titanyl sulfate.

[0035] Also the Zr compound is not specifically limited, but a Zr salt is preferred in view of practical use or performances. Examples of the Zr salt include zirconium phosphate, zirconium hydrofluoric acid and lithium, sodium, ammonium and other salts thereof, zirconium sulfate, zirconyl sulfate, and zirconyl nitrate.

Method of forming the resin layer

[0036] The method of forming the above-described inorganic-organic resin is not specifically limited. For example, the inorganic-organic resin layer can be obtained by dipping in a treating solution prepared by mixing the above-described organic resin (e.g. epoxy-based resin, phenol-based resin, urethane-based resin, vinyl-based resin, ester-based resin, styrene-based resin, etc.) with the above-described phosphoric acid-based compound, organosilicon compound or Ti compound or Zr compound, followed by squeezing using a ringer roll and further drying.

Laminated film

[0037] The laminating film is not specifically limited and may be a known laminating film. For example, a laminating film made of polyethylene, polycarbonate and polyester can be used. The thickness of the film is not specifically limited. Generally, a film having a thickness within a range from 5 to 40 μm is used.

[0038] The laminating method is not specifically limited. The method of laminating by softening with heating is preferred but an adhesive may be used.

Steel sheet for a laminated container

[0039] The resulting steel sheet for a laminated container according to the present invention is schematically shown in Fig. 1 and Fig. 2.

[0040] Fig. 1 shows an example of a steel sheet for a laminated container, in which a Ni plating layer 2 is formed on the surface of a steel sheet 1 and an organic resin layer 4 is formed thereon. Fig. 2 shows another example of a steel sheet for a laminated container, in which a Sn plating layer 2 is formed on the surface of a steel sheet 1 and a chromate plating layer 3 is formed thereon, and an inorganic-organic resin layer 4 is further formed thereon. The number and combination of plating layers are not specifically limited, though one or two plating layers were formed in Fig. 1 and Fig. 2. However, it is preferred to have an Sn plating layer for particularly severe shaping process.

Container made of a laminated steel sheet

[0041] An example using the steel sheet for a laminated container of the present invention is shown in Fig. 3. The container made of the laminated steel sheet of the present invention can be applied to any of a two-piece can and a three-piece can and is not limited to the example of Fig. 3, as a matter of course. A laminating film 5 is laminated on a surface-treating layer and an organic resin layer or an inorganic-organic resin layer 2 to 4 of the steel sheet for a laminated container shown in Fig. 2. Using the thus obtained steel sheet for a laminated container, a closed-end can 6 is formed by deep drawing, as shown in Fig. 3. A closed can is completed, after optionally necking or flanging this closed-end can 6, by curling with a cap (not shown) made of steel or Al.

[0042] In Fig. 3, the laminating film 5 of the present invention is formed on the inside 7 of the can. Commonly, the outside of the can is also provided with a laminating film or with a coating layer, but its construction does not cause any problem in the present invention.

[0043] In the laminated container using the steel sheet for a laminated container of the present invention, the adhesion of the laminated film to the steel sheet is not deteriorated even if a severe shaping process such as drawing is performed. Because of excellent corrosion resistance and weldability, even when used as a beverage can and stored for a long period, unpleasant odor and taste due to organic materials are not caused.

(Second aspect)

[0044] The steel sheet for a laminated container having particularly excellent weldability as a second aspect, which is a preferred embodiment of the first aspect of the present invention, will be described in detail below.

Substrate

[0045] The substrate to be used may be the same as that described previously.

Plating layer

[0046] A steel sheet for a laminated container, which is superior in weldability and is also superior in film adhesion properties and corrosion resistance, as a second aspect of the present invention, is provided by forming on a steel sheet, a Ni-based plating layer, an Sn-based alloy layer and an Sn-based plating layer in this order from the steel sheet, preferably, further forming a chromate layer thereon, and further an organic resin layer or an inorganic-organic resin layer thereon.

Ni-based plating

[0047] Examples of a Ni-based plating to be applied onto the substrate include a Ni plating, a Fe-Ni alloy plating, and an Ni diffusion plating, and the Ni plating or Fe-Ni alloy plating may be performed by a known electroplating method. The Ni diffusion plating may be performed by Ni plating and then a heat treatment at 600-1000°C to form a Ni diffusion layer. A temper rolling may also be performed after forming the Ni diffusion layer, which does not depart from the essence of the present invention.

[0048] The Ni plating layer plays a role of providing a corrosion resistance of the steel sheet of the present invention utilizing excellent corrosion resistance of metallic Ni itself. If the amount of Ni plated is smaller than 5 mg/m², the resulting steel sheet does not have excellent corrosion resistance of metallic Ni itself. Therefore, the amount of not less than 5 mg/m² of the Ni plating is required. On the other hand, as the amount of Ni increases, the corrosion resistance is more improved. However, if the amount of Ni exceeds 500 mg/m², the improving effect is saturated and, therefore, it is economically disadvantageous. Accordingly, the amount of Ni is controlled to not less than 5 mg/m² and not more than 500 mg/m².

Sn plating

[0049] To secure the weldability, Sn plating is then applied. Since Sn is a soft metal, a chromate or phenol resin layer described below is broken when interposed between electrodes during seam welding, thereby making it possible to secure good electric conduction regions. Therefore, good weldability (particularly resistance weldability) can be secured in the steel sheet of the present invention. An Sn plating may be performed by a known method such as Sn electroplating and is not specifically limited.

[0050] To attain excellent weldability, the amount of Sn plating of not less than 100 mg/m² is required. The reason is as follows. That is, if the amount of Sn is smaller than 100 mg/m², high-speed weldability required to industrial production is deteriorated and, therefore, the amount of Sn of not less than 100 mg/m² is required. The weldability of the steel sheet of the present invention is improved as the amount of Sn increases. On the other hand, if the amount of Sn exceeds 1500 mg/m², the improving effect is saturated. Therefore, it is economically disadvantageous. Accordingly, the amount of Sn is controlled within a range from 100 to 1500 mg/m².

Sn reflowing treatment (alloying, dispersing)

[0051] The Sn plating is followed by an Sn reflowing treatment, to form an Sn alloy layer and a dispersed Sn plating layer ("dispersed Sn (plating layer)" referred to as "a layer of Sn island regions" in this specification.) thereon. The Sn

reflowing treatment is performed for two purposes. One purpose is to alloy the Ni plating layer formed previously with Sn, thereby improving the corrosion resistance, while another object is to form a dispersed Sn, thereby improving high-temperature adhesion properties of the film. In the vicinity of the welding portion, the temperature rises up to above the melting point of Sn, so that Sn turns into a liquid state and the film adhesion property is drastically deteriorated. To secure the film adhesion properties even at a high temperature, it is necessary that Sn is dispersed, so that an alloy layer of the Ni plating layer having a high melting point and Sn can be exposed.

[0052] Accordingly, the area ratio of dispersed Sn is controlled to 95% or less to secure the film adhesion properties at a high temperature. If the area ratio of Sn exceeds 95%, Sn is excessively exposed and the film adhesion property at a high temperature is deteriorated and, therefore, the area ratio of Sn must be controlled to 95% or less. As the area ratio of Sn is reduced, the effect of improving the film adhesion properties at high temperature is more enhanced. However, if the area ratio of Sn is smaller than 40%, excellent weldability of the metallic Sn is deteriorated and, therefore, the area ratio of Sn must be controlled to 40% or more.

[0053] The method of dispersing Sn is not specifically limited, and the Sn-coated steel sheet may be heated to the melting point of Sn or higher by electrically or inductively heating. In this heating, dispersion is accelerated by using a very low concentration of a flux, or water in place of the flux. Therefore, by controlling the flux concentration, dispersed Sn with a desired area ratio can be obtained.

Chromate

[0054] The Sn plating is preferably followed by formation of a chromate layer to attain more excellent film adhesion property and corrosion resistance. The chromate layer comprises hydrated Cr oxide, or hydrated Cr oxide and metallic Cr. It is necessary that the amount of hydrated Cr oxide deposited is not less than 2 mg/m² calculated in terms of metallic Cr and the amount of the entire chromate layer is within a range from 4 to 40 mg/m² calculated in terms of metallic Cr. This reason is as follows. This is because hydrated Cr oxide is indispensable to secure an excellent adhesion property. When the amount of hydrated Cr oxide deposited is not less than 2 mg/m² calculated in terms of metallic Cr, the effect of improving the adhesion property is attained. To secure excellent corrosion resistance, the chromate layer preferably exists in an amount of not less than 4 mg/m² calculated in terms of metallic Cr. When the amount of the chromate layer is smaller than 4 mg/m², excellent corrosion resistance of Cr is not attained and sufficient corrosion resistance is less likely to be secured.

[0055] As the amount of chromate increases, the effect of improving the corrosion resistance is also more enhanced. However, since the chromate layer is an insulating coating, the weldability is rapidly deteriorated if the amount exceeds 40 mg/m² calculated in terms of metallic Cr. Accordingly, the amount of the chromate layer is desirably within a range from 4 to 40 mg/m² calculated in terms of metallic Cr.

[0056] The method of forming the chromate layer is not specifically limited and, for example, an electrolytic treatment or a dipping treatment may be performed in a Cr acid solution, a chromic acid-sulfuric acid solution, or a chromic acid-fluoric acid solution.

Phenol-based resin coating

[0057] After forming the Sn plating layer or chromate layer, a coating made of a phenol-based resin containing a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P is formed with a thickness of 1 - 500 nm. This layer may be the same as that described above.

Laminating film

[0058] This laminating film may be the same as that described above.

Steel sheet for a laminated container

[0059] An example of the steel sheet for a laminated container of the second aspect according to the present invention, as produced above, is schematically shown in Fig. 4 and Fig. 5. In Fig. 4, the numerical reference 11 denotes a steel sheet as the substrate, 12 denotes a metallic Ni-based plating layer, 13 denotes a Sn-based alloy layer, 15 denotes a metallic Sn plating layer, and 16 denotes an organic resin layer. In Fig. 5, the numerical reference 11 denotes a steel sheet as the substrate, 12 denotes a metallic Ni-based plating layer, 13 denotes a Sn-based alloy layer, 14 a dispersed metallic Sn plating layer, 15 denotes a chromate layer, and 16 denotes an inorganic-organic resin layer. After a laminating film 17 was laminated on the organic resin layer or inorganic-organic resin layer 16, a can is produced therefrom.

[0060] The surface-treatment and laminating film side, including the metallic Ni-based plating layer 12, Sn-based alloy layer 13, metallic Sn plating layer 15, and organic resin layer or inorganic-organic resin layer 16 of the steel sheet

for a laminated container, has been developed with the intention of being used as the inside of the container (beverage can). Accordingly, the opposite side may be optionally provided with a surface print layer or any other layers.

Production of a laminated container

[0061] Referring to Fig. 6, an example of a can, produced by welding the steel sheet for a laminated container shown in Fig. 4 or 5, is shown. As a matter of course, the container as the second aspect according to the present invention is not limited thereto.

[0062] After laminating a laminating film on the organic resin layer or an inorganic-organic resin layer of the steel sheet for a laminated container by a known method, the resulting laminated steel sheet 18 for canning is cut into a predetermined shape for can, and made into a cylindrical shape and then an edge 19 of the cylindrical portion is welded through a known welding process, preferably resistance welding. The space between the cylindrical can thus obtained and a closure or end cover is commonly sealed with a sealing compound.

EXAMPLES

[0063] The Examples and Comparative Examples of the present invention will be described. The results are shown in the tables.

Example 1

[0064] According to the following procedures (1) to (7), surface-treatment layers were formed on a steel sheet.

(Procedure 1)

[0065] A substrate having been subjected to annealing and temper rolling after cold rolling was plated with Sn in a ferrosan bath, and then optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide hydrated Cr oxide thereon.

(Procedure 2)

[0066] A substrate having been subjected to annealing and temper rolling after cold rolling was plated with Ni in a Watts bath, and then optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide hydrated Cr oxide thereon.

(Procedure 3)

[0067] A substrate having been subjected to cold rolling was plated with Ni in a Watts bath and, after a Ni diffusion layer was formed by annealing, the sheet was optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide hydrated Cr oxide thereon.

(Procedure 4)

[0068] A substrate having been subjected to annealing and temper rolling after cold rolling was plated with Fe in a sulfuric acid-hydrochloric acid bath, and then optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide hydrated Cr oxide thereon.

(Procedure 5)

[0069] A substrate having been subjected to annealing and temper rolling after cold rolling was subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide hydrated Cr oxide thereon.

(Procedure 6)

[0070] A substrate having been subjected to annealing and temper rolling after cold rolling was plated with a Fe-Ni alloy in a sulfuric acid-hydrochloric acid bath, then plated with Sn in a ferrosan bath, subjected to a heat treatment to thereby alloy a portion of the Sn plating layer, and then optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide hydrated Cr oxide thereon.

(Procedure 7)

[0071] A substrate having been subjected to annealing and temper rolling after cold rolling was plated with a Sn-Ni alloy in a sulfuric acid-hydrochloric acid bath, and then optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide hydrated Cr oxide thereon.

[0072] After the surface-treatment layer was formed according to the procedure described above, a coating made of an inorganic-organic resin was formed according to the following procedures (8) to (13).

(Procedure 8)

[0073] The above steel sheet was dipped in a treating solution prepared by dissolving a phenol resin and phosphoric acid and, optionally, titanium ammonium phosphate, and then dried, thereby to form a coating made of an inorganic-organic resin.

(Procedure 9)

[0074] The above steel sheet was dipped in a treating solution prepared by dissolving an urethane resin and mono-propyltriethoxysilane and, optionally, zirconium sulfate, and then dried, thereby to form a coating made of an inorganic-organic resin.

(Procedure 10)

[0075] The above steel sheet was dipped in a treating solution prepared by dissolving 85% phenol resin-15% epoxy resin and sodium phosphate and, optionally, titanium sulfate or zirconium sulfate, and then dried, thereby to form a coating made of an inorganic-organic resin.

(Procedure 11)

[0076] The above steel sheet was dipped in a treating solution prepared by dissolving a phenol resin and titanium fluoride, and then dried, thereby to form a coating made of an inorganic-organic resin.

(Procedure 12)

[0077] The above steel sheet was dipped in a treating solution prepared by dissolving 85% phenol resin-15% epoxy resin, and then dried, thereby to form a coating made of an organic resin.

[0078] The above treated materials were laminated with a polyethylene film having a thickness of 20 nm to make test materials, and then the performances thereof were evaluated with respect to the following items (A) to (D).

(A) Formability or shapability

[0079] After the test material was coated with normal butyl stearate as a lubricant, a cup (140 mm ϕ) was punched out from the test material and drawing and ironing were performed in a stepwise manner at a draw ratio of 2.1 (hereinafter referred to as "drawing and ironing"). Then, the formability was evaluated by four-rank criteria (⊙: excellent, ○: good, Δ: scar is recognized, ×: impossible to work because of rupture).

(B) Weldability

[0080] Using a wire electrode seam welding technique, welding was performed with changing the current under the conditions of a welding wire speed of 80 m/min. and the weldability was generally judged by the extent of a proper current range from the minimum current for a sufficient welding strength to the maximum current at which welding defects such as dusts, welding sputtering and the like occur frequently. Consequently, the weldability was evaluated by four-rank criteria (⊙: very wide, ○: good, Δ: poor, X: impossible to weld).

(C) Film adhesion property

[0081] After the test material was coated with normal butyl stearate as a lubricant, a cup (140 mm ϕ) was punched out from the test material and the drawing and ironing were performed at a draw ratio of 2.1. The test material was subjected to a retort treatment at 125°C for 30 minutes and the state of peeling of the film was evaluated by four-rank

criteria (⊙: no peel, ○: very slight peel but suitable to be put into practice, Δ: slight peel, ×: severe peel).

(D) Corrosion resistance

[0082] After the test material was coated with normal butyl stearate as a lubricant, a cup (140 mmφ) was punched out from the test material and the drawing and ironing were performed in a stepwise manner at a draw ratio of 2.1, thereby to make a can. The can was filled with a test solution of a 1.5% citric acid-1.5% sodium chloride mixed solution and provided with a closure, and then allowed to stand in a temperature-controlled chamber at 55°C for one month. The state of corrosion on the inside of the can was evaluated by four-rank criteria (⊙: no corrosion is recognized, ○: such a very slight corrosion but sufficiently low to be put into practice is recognized, Δ: slight corrosion is recognized, ×: severe corrosion is recognized).

[0083] The results are shown in Table 1. As is apparent from the results, the steel sheets for a laminated container having excellent canning processability produced by the present invention had excellent formability, weldability, film adhesion property and corrosion resistance.

Table 1: Examples and Comparative Examples

No.	Surface-treatment layer		Organic resin or inorganic-organic resin					
	Procedure	Amount of metal (mg/m ²)	Procedure	Thickness (nm)	Amount of P deposited (mg/m ²)	Amount of Si deposited (mg/m ²)	Amount of Ti deposited (mg/m ²)	Amount of Zr deposited (mg/m ²)
1	1	Sn: 2800	8	80	0.9	0	12	0
2	1	Sn: 580 Cr: 85	10	7	68	0	0	0
3	1	Sn: 4700 Cr: 6	9	4	0	0.4	0	28
4	2	Ni: 57	9	420	0	42	0	214
5	2	Ni: 550 Cr: 10	10	250	20	0	0.9	0
6	2	Ni: 750	8	77	3	0	240	0
7	3	Ni: 450 Cr: 6	8	150	0.2	0	90	0
8	3	Ni: 80	10	16	1	0	250	0.3
9	4	Fe: 280 Cr: 140	9	3	0	2	0	0
10	4	Fe: 40	8	250	12	0	2	0
11	5	Cr: 150	8	18	8	0	0	0
12	6	Fe: 400 Ni: 60 Sn: 800 Cr: 10	10	44	0.3	0	4	77
13	6	Fe: 40 Ni: 130 Sn: 2000	8	330	22	0	0.4	0
14	7	Sn: 760 Ni: 40	8	210	44	0	0	0
15	7	Sn: 5400 Ni: 19 Cr: 58	10	55	0.7	0	1	3
16	3	Ni: 500	11	40	0	0	3.1	0
17	3	Ni: 1000	11	14	0	0	0	2.8
18	7	Sn: 1000 Ni: 19 Cr: 58	12	25	0	0	0	0

Table 1: Examples and Comparative Examples (continued)

No.	Evaluation				Remarks
	Formability	Weldability	Film adhesion property	Corrosion resistance	
1	⊙	⊙	⊙	⊙	Examples of the present invention
2	○	⊙	⊙	⊙	
3	⊙	⊙	⊙	⊙	
4	○	⊙	⊙	⊙	
5	○	⊙	⊙	⊙	
6	○	⊙	⊙	⊙	
7	○	⊙	⊙	⊙	
8	○	⊙	⊙	⊙	
9	○	⊙	⊙	⊙	
10	○	⊙	⊙	⊙	
11	○	-	⊙	⊙	
12	⊙	⊙	⊙	⊙	
13	⊙	⊙	⊙	⊙	
14	⊙	⊙	⊙	⊙	
15	⊙	⊙	⊙	⊙	
16	○	⊙	⊙	⊙	
17	○	⊙	⊙	⊙	
18	○	○	○	○	

Table 1 (continued)

No.	Surface-treatment layer		Organic resin or inorganic-organic resin					
	Procedure	Amount of metal (mg/m ²)	Procedure	Thickness (nm)	Amount of P deposited (mg/m ²)	Amount of Si deposited (mg/m ²)	Amount of Ti deposited (mg/m ²)	Amount of Zr deposited (mg/m ²)
20	1	Sn: 580 Cr: 85	none	0	0	0	0	0
21	2	Ni: 450 Cr: 19	none	0	0	0	0	0
22	5	Cr: 200	none	0	0	0	0	0
23	none	-	9	16	20	0	1.0	0

Table 1 (continued)

No.	Evaluation				Remarks
	Formability	Weldability	Film adhesion property	Corrosion resistance	
20	○	⊙	×	×	Comp. Examples
21	○	⊙	×	×	
22	○	-	×	×	
23	△ or ×	×	△	×	

Example 2

[0084] According to the following procedures (21) to (22), surface-treatment layers were formed on a steel sheet, and then a phenol-based resin was provided thereon according to the procedure (23).

Method for production of test material

(Procedure 21)

[0085] A substrate having been subjected to annealing and temper rolling after cold rolling was electroplated with a Fe-Ni alloy, plated with Sn in a ferrosan bath, subjected to a heat treatment with a low concentration of a flux, thereby to form dispersed Sn, and then optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide a chromate layer thereon.

(Procedure 22)

[0086] A substrate having been subjected to Ni plating by electrical plating, annealing and temper rolling after cold rolling was plated with Sn in a halogen bath, subjected to a heat treatment, thereby to form dispersed Sn, and then optionally subjected to an electrolytic treatment in a chromic acid-sulfuric acid solution, thereby to provide a chromate layer thereon.

(Procedure 23)

[0087] The above steel sheet was dipped in a treating solution prepared by dissolving a phenol resin and phosphoric acid and, optionally, titanium ammonium phosphate, and then dried, thereby to form a coating made of a phenol-based resin thereon.

Method for evaluation of test material

[0088] The above treated materials were laminated with a polyethylene film having a thickness of 20 nm at 200°C to make a test material, and then performances thereof were evaluated with respect to the following items.

(A) Weldability

[0089] The weldability test was the same as that in Example 1.

(B') Film adhesion property

[0090] After stretching by 10%, the test material was subjected to a retort treatment at 125°C for 30 minutes and the state of peeling of the film was evaluated by four-rank criteria (⊙: no peel, ○: such a very slight peel but sufficiently low to be put into practice, △: slight peel, ×: severe peel).

(D') Corrosion resistance

[0091] A can was made by welding the bonding portion of a cylindrical body, as shown in Fig. 6, and providing a side with EOE (easy open end) made of Al. The can was filled with a test solution of a 1.5% citric acid-1.5% sodium chloride mixed solution and provided with a closure, and then allowed to stand in a temperature-controlled chamber at 55°C for one month. The state of corrosion on the inside of the can was evaluated by four-rank criteria (⊙: no corrosion is recognized, ○: very slight corrosion but sufficiently low to be put into practice is recognized, Δ: slight corrosion is recognized, X: severe corrosion is recognized).

(C) High-temperature film adhesion property

[0092] The test material was provided with a crosscut, which reaching the substrate steel, heated rapidly to 250°C, and then air (5 atm) was blown into the center of the crosscut. The state of peeling of the film was evaluated by four-rank criteria (⊙: no peel, ○: very slight peel but sufficiently low to be put into practice, Δ: slight peel, ×: severe peel).

[0093] The results are shown in Table 2. As is apparent from the results, the steel sheets for a laminated container having excellent canning processability produced by the present invention had excellent formability, weldability, film adhesion property and corrosion resistance.

Table 2: Examples and Comparative Examples

No.	Plating layer					Phenol-based resin				
	Procedure	Ni (mg/m ²)	Sn (mg/m ²)	Area ratio of Sn (%)	Chromate (mg/m ²)	Ox-Cr (mg/m ²)	Thickness (nm)	P (mg/m ²)	Ti (mg/m ²)	Zr (mg/m ²)
31	21	320	1250	50	17	10	80	0.9	12	0
31	21	28	360	92	38	2	7	68	0	10
33	22	75	870	62	27	8	4	44	0	0
34	22	7	120	44	24	15	420	0.2	0	214
35	21	125	1420	76	6	3	250	20	0.9	0
36	21	486	980	89	0	0	77	3	240	0.4
41	22	66	990	55	<u>58</u>	6	<u>0.4</u>	0.05	0.5	0

No.	Evaluation				Remarks
	Weldability	Film adhesion property	High- temperature film adhesion property	Corrosion resistance	
31	⊙	⊙	⊙	⊙	Examples of the present invention
31	⊙	⊙	○	⊙	
33	⊙	⊙ - ○	⊙	⊙	
34	○	⊙	⊙	⊙	
35	⊙	⊙	⊙	⊙	
36	⊙	⊙ - ○	⊙	⊙ - ○	Comp. Example
41	△ or ×	×	○	×	

Note) Underlined numerical values are not within the scope of the present invention.

INDUSTRIAL APPLICABILITY

[0094] The steel sheet for a laminated container of the present invention and the container using the same have excellent adaptability to a severe canning process as well as excellent film adhesion properties, corrosion resistance and weldability. Therefore, they are particularly useful as a container (can) for beverages and materials therefor.

Claims

1. A steel sheet for a laminated container having excellent canning processability **characterized by** having, on at least one surface of a steel sheet, a surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide, and thereon a coating made of an organic resin or inorganic-organic resin having a thickness within a range from 1 to 500 nm.
2. The steel sheet for a laminated container according to claim 1, wherein said coating of the organic resin is a coating of an organic resin containing one or more of phosphoric acid-based compounds in an amount of not less than 0.1 mg/m² calculated in terms of P and organosilicon compounds in an amount of not less than 0.1 mg/m² calculated in terms of Si.
3. The steel sheet for a laminated container according to claim 1, wherein said coating of the organic resin is a coating of a phenol-based resin containing one or more of phosphoric acid-based compounds in an amount of not less than 0.1 mg/m² calculated in terms of P and organosilicon compounds in an amount of not less than 0.1 mg/m² calculated in terms of Si.
4. The steel sheet for a laminated container according to claim 1, wherein said coating of the inorganic-organic resin is a coating of an inorganic-organic resin containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal.
5. The steel sheet for a laminated container according to claim 1, wherein said coating of the inorganic-organic resin is a coating of a phenol-based resin containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of metal.
6. The steel sheet for a laminated container according to claim 1, wherein said coating of the inorganic-organic resin is a coating of an inorganic-organic resin which contains one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal and further contains one or more of phosphoric acid-based compounds in an amount of not less than 0.1 mg/m² calculated in terms of P and organosilicon compounds in an amount of not less than 0.1 mg/m² calculated in terms of Si.
7. The steel sheet for a laminated container according to claim 1, wherein said coating made of the inorganic-organic resin is a coating of a phenol-based resin which contains one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal and further contains one or more of phosphoric acid-based compounds in an amount of not less than 0.1 mg/m² calculated in terms of P and organosilicon compounds in an amount of not less than 0.1 mg/m² calculated in terms of Si.
8. The steel sheet for a laminated container according to claim 3, 5 or 7, wherein the content of the phenol resin in the coating of the phenol-based resin is not less than 70%.
9. The steel sheet for a laminated container having excellent canning processability according to any one of claims 1 to 8, wherein said surface-treatment layer containing one or more of Sn, Ni, Fe, Cr and hydrated Cr oxide comprises Sn in an amount within a range from 80 to 6000 mg/m² calculated in terms of the metallic Sn, Ni in an amount within a range from 10 to 800 mg/m² calculated in terms of the metallic Ni, Fe in an amount within a range from 10 to 800 mg/m² calculated in terms of the metallic Fe, or Cr and hydrated Cr oxide in an amount within a range from 2 to 200 mg/m² calculated in terms of the metallic Cr.
10. A steel sheet for a laminated container, **characterized by** having, on at least one surface of a steel sheet, in order, a Ni-based plating layer containing Ni in an amount within a range from 5 to 500 mg/m² calculated in terms of the metallic Ni, an Sn-based alloy layer, and a metallic Sn plating layer in an amount within a range from 100 to 1500 mg/m², and further thereon a coating made of a phenol-based resin having a thickness within a range from 1 to

500 nm, said phenol-based resin containing a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P.

- 5 11. The steel sheet for a laminated container according to claim 10, wherein said metallic Sn plating layer is a dispersed metallic Sn plating layer.
- 10 12. The steel sheet for a laminated container according to claim 11, further comprising on said dispersed metallic Sn plating layer, a chromate layer in an amount within a range from 4 to 40 g/m² calculated in terms of the metallic Cr and further thereon said phenol-based resin coating layer, said phenol-based resin coating layer being a coating made of a phenol-based resin containing a phosphoric acid-based compound in an amount within a range from 0.1 to 200 mg/m² calculated in terms of P.
- 15 13. The steel sheet for a laminated container according to claim 11, wherein said phenol-based resin coating layer is a coating layer made of a phenol-based resin which contains a phosphoric acid-based compound in an amount of not less than 0.1 mg/m² calculated in terms of P and also contains one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal.
- 20 14. The steel sheet for a laminated container according to claim 12, wherein said phenol-based resin coating layer is a coating layer made of a phenol-based resin containing one or more of Ti or Zr or compounds thereof in an amount within a range from 0.2 to 300 mg/m² calculated in terms of the metal, in addition to said phosphoric acid-based compound.
- 25 15. The steel sheet for a laminated container according to any one of claims 11 to 14, wherein an area ratio of dispersed Sn in said dispersed metallic Sn plating layer is within a range from 40 to 95%.
- 30 16. The steel sheet for a laminated container according to claim 12 or 14, wherein said chromate layer contains at least hydrated Cr oxide in an amount of not less than 2 mg/m² calculated in terms of the metallic Cr.
- 35 17. A method of producing a can using a laminated steel sheet, which comprises producing a can by a drawing or ironing process using said steel sheet for a laminated container of any one of claims 1 to 9.
- 40 18. A method of producing a can using a laminated steel sheet, which comprises producing a can by a welding process using said steel sheet for a laminated container of any one of claims 10 to 16.
- 45 19. A can made of a laminated steel sheet, which is produced by a drawing or ironing process using said steel sheet for a laminated container of any one of claims 1 to 9.
- 50 20. A can made of a laminated steel sheet, comprising a welded portion, using said steel sheet for a laminated container of any one of claims 1 to 9.
- 55

Fig.1

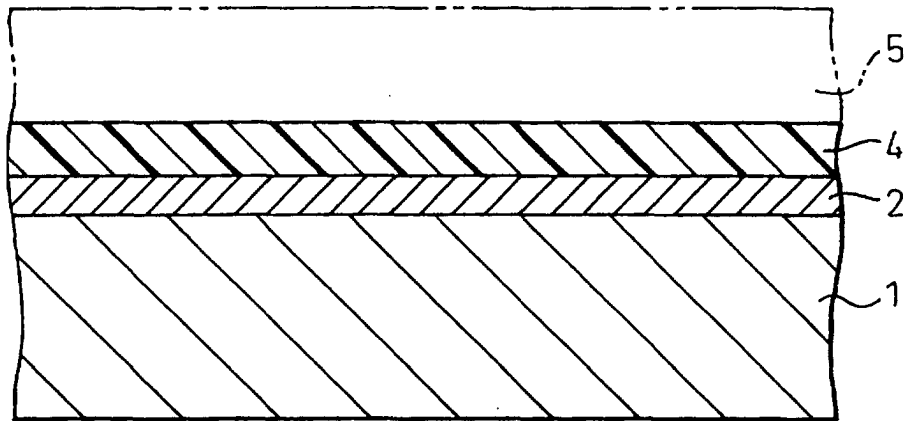


Fig.2

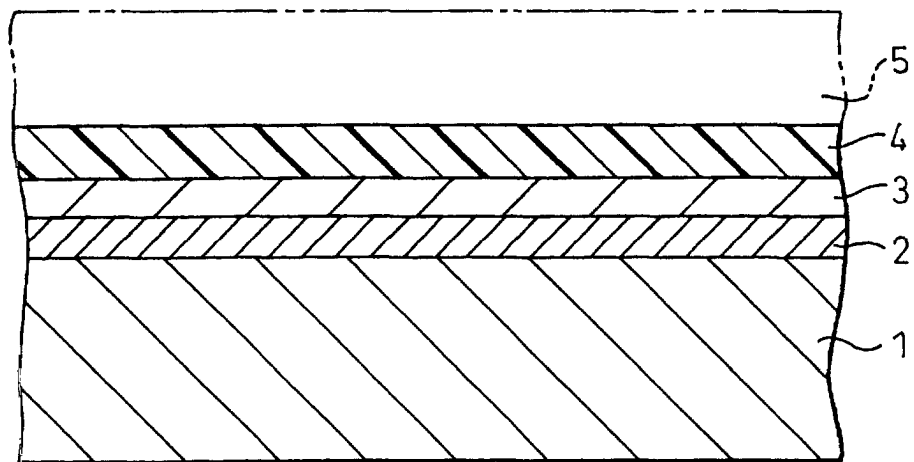


Fig.3

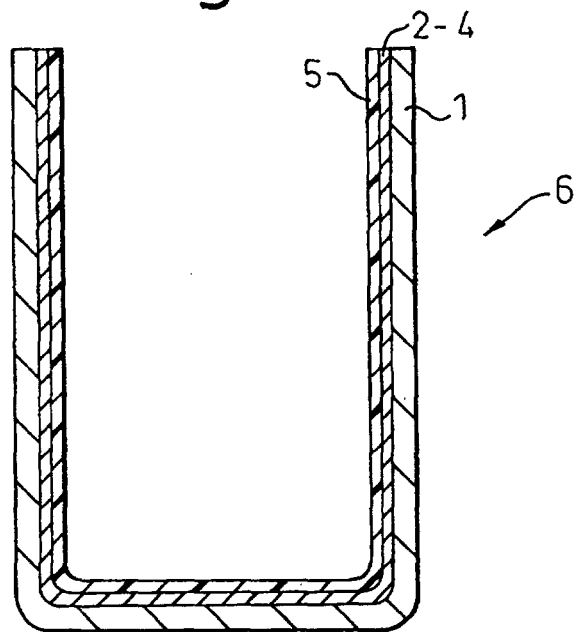


Fig.4

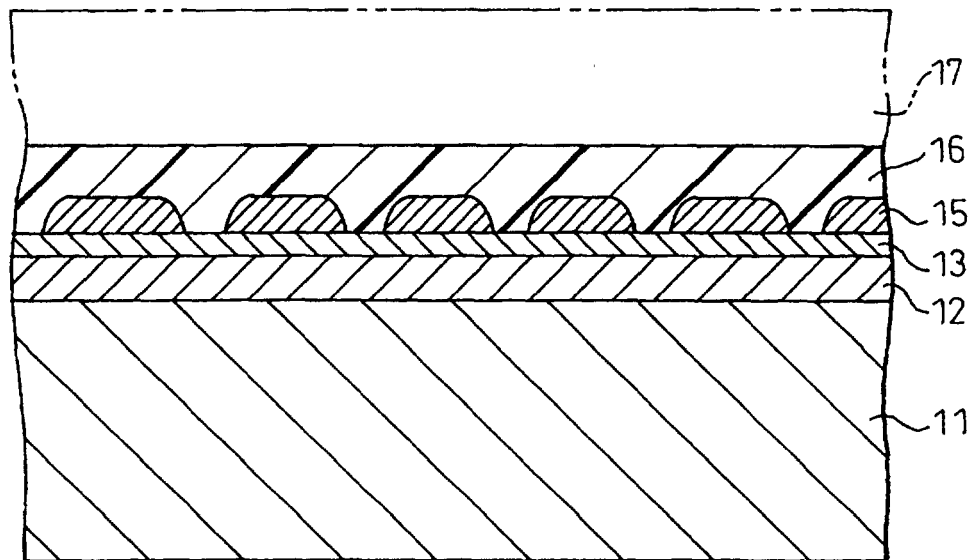


Fig.5

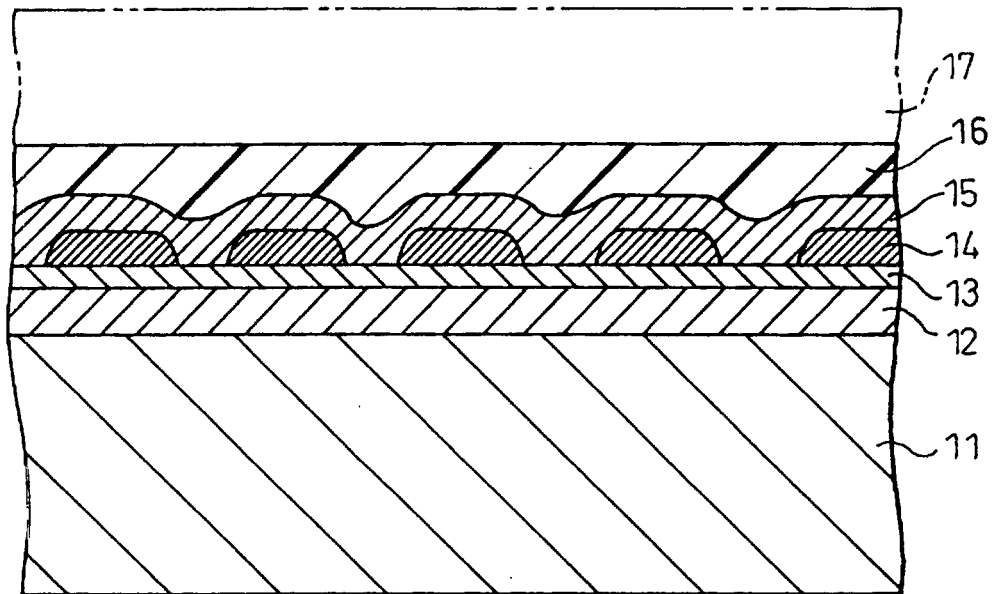
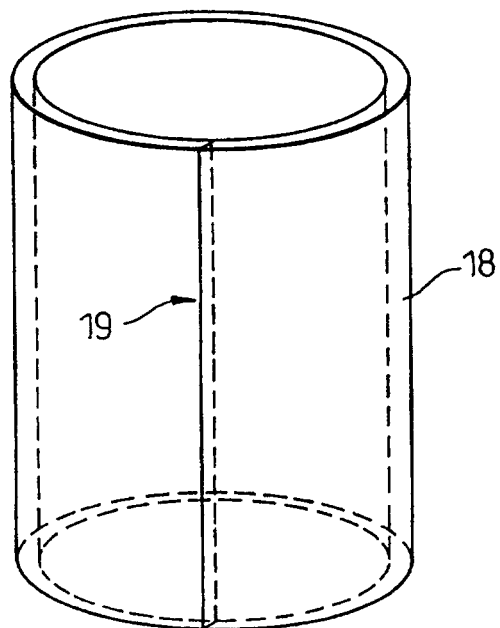


Fig.6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/04556

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ C23C 28/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁷ C23C 28/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2000 Kokai Jitsuyo Shinan Koho 1971-2000 Jitsuyo Shinan Toroku Koho 1996-2000		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 9-1060, A (Nkk Corporation), 07 January, 1997 (07.01.97) (Family: none)	1, 9, 17-20
A	JP, 7-138786, A (Toyo Kohan Co., Ltd.), 30 May, 1995 (30.05.95) (Family: none)	2-8, 10-16
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 14 September, 2000 (14.09.00)		Date of mailing of the international search report 26 September, 2000 (26.09.00)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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