CLAIMS

[Claim 1]

A high-strength surface-coated steel sheet comprising:

a base steel sheet having a steel composition by mass of C: 0.01 to 0.16%, Si: 0.01 to 0.25%, Mn: 0.10 to 2.50%, P: 0.005 to 0.050%, B: 0.0005 to 0.010%, Ti: 0.01 to 0.20%, Nb: 0 to 0.10%, Mo: 0 to 0.50%, Cr: 0 to 0.50%, Al: 0.01 to 0.10%, and the balance of Fe and inevitable impurities; and

a Zn-Al-Mg-based coating layer disposed on a surface of the base steel sheet, the Zn-Al-Mg-based coating layer having a metal element composition ratio by mass of Al: 1.0 to 22.0%, Mg: 1.3 to 10.0%, Si: 0 to 2.0%, Ti: 0 to 0.10%, B: 0 to 0.05%, Fe: 2.0% or less, and the balance of Zn and inevitable impurities,

the high-strength surface-coated steel sheet having cracks having a total extension of 3.0 to 8.0 mm per mm^2 in a plating layer surface, having a diffusible hydrogen concentration in the base steel sheet of 0.30 ppm or less and having a time until occurrence of red rust of 7000 hours or more as measured by a neutral salt spray test (salt concentration: 50 g/L, temperature: 35°C, back face and edge face seal of test piece: present) according to JIS Z2371:2015.

[Claim 2]

The high-strength surface-coated steel sheet according to claim 1, wherein the high-strength surface-coated steel sheet has a tensile strength in a rolling direction of 590 MPa or higher.

[Claim 3]

The high-strength surface-coated steel sheet according to claims 1 or 2, wherein the Zn-Al-Mg-based coating layer has a mean thickness of 3 to 100 μm.

[Claim 4]

The high-strength surface-coated steel sheet according to any one of claims 1 to 3, wherein a surface of the coating layer has a lightness L^* of 60 or less, wherein L^* is a lightness index L^* in the CIE 1976 $L^*a^*b^*$ color space.

[Claim 5]

The high-strength surface-coated steel sheet according to any one of claims 1 to 4, further comprising an inorganic coating on a surface of the Zn-Al-Mg-based coating layer.

[Claim 6]

The high-strength surface-coated steel sheet according to any one of claims 1 to 4, further comprising an organic coating on a surface of the Zn-Al-Mg-based coating layer.

[Claim 7]

A method for producing the high-strength surface-coated steel sheet according to any one of claims 1 to 3, the method comprising:

a step of heating a base steel sheet having the steel composition in a mixed gas of hydrogen and nitrogen to 550 to 900°C, then immersing the heated steel sheet in a hot-dip plating bath having a composition by mass of Al: 1.0 to 22.0%, Mg: 1.3 to 10.0%, Si: 0 to 2.0%, Ti: 0 to 0.10%, B: 0 to 0.05%, Fe: 2.0% or less, and the balance of Zn and inevitable impurities using hot-dip plating equipment without exposed to the air atmosphere to produce a hot-dip Zn-Al-Mg-based-plated steel sheet (hot-dip plating step);

a step of imparting a strain of a total elongation rate of 0.2 to 1.0% to the hot-dip Zn-Al-Mg-based-plated steel sheet using any one or both of a tension leveler and a rolling mill to introduce a crack into a plating layer (crack introducing step); and

a step of heating and holding the hot-dip Zn-Al-Mg-based-plated steel sheet having a crack introduced at 70 to 150°C to decrease a diffusible hydrogen concentration in the base steel sheet to 0.30 ppm or less (baking treatment step).

[Claim 8]

A method for producing the high-strength surface-coated steel sheet according to any one of claims 1 to 4, the method comprising:

a step of heating a base steel sheet having the steel composition in a mixed gas of hydrogen and nitrogen to 550 to 900°C, and then immersing the heated steel sheet in a hot-dip plating bath having a composition by mass of Al: 1.0 to 22.0%, Mg: 1.3 to 10.0%, Si: 0 to 2.0%, Ti: 0 to 0.10%, B: 0 to 0.05%, Fe: 2.0% or less, and the balance of Zn and inevitable impurities without exposed to the air atmosphere using hot-dip plating equipment to produce a hot-dip Zn-Al-Mg-based-plated steel sheet (hot-dip plating step);

a step of imparting a strain of a total elongation rate of 0.2 to 1.0% to the hot-dip Zn-Al-Mg-based-plated steel sheet using any one or both of a tension leveler and a rolling mill to introduce a crack into a plating layer (crack introducing step); and

a step of heating and holding the hot-dip Zn-Al-Mg-based-plated atmosphere to bring a surface of the plating layer into contact with steam, thereby decreasing a diffusible hydrogen concentration in the base steel sheet to 0.30 ppm or less (baking treatment step).

[Claim 9]

The method for producing the high-strength surface-coated steel sheet according to claim 7 or 8, wherein the diffusible hydrogen concentration in the base steel sheet is decreased to 0.20 ppm or less in the baking treatment

step.

[Claim 10]

The method for producing the high-strength surface-coated steel sheet according to any one of claims 7 to 9, wherein the plated steel sheet to be subjected to the baking treatment step has a diffusible hydrogen concentration in the base steel sheet of 0.35 ppm or more.