consisting of a polyatomic ion including V^{5+}, a polyatomic ion including Si^{4+}, and a polyatomic ion including Cr^{6+}, in which the aqueous solution contains the polyatomic ion in a concentration of 0.01 g/L or more in terms of one of or two or more of atoms selected from the group consisting of V, Si, and Cr.

[2] The method for producing a hot-dip Zn alloy-plated steel sheet according to [1], in which a temperature of the surface of the hot-dip Zn alloy plating layer obtained when the aqueous solution is contacted with the surface of the hot-dip Zn alloy plating layer is 100°C or above and equal to or less than a solidifying point of the plating layer.

[3] The method for producing a hot-dip Zn alloy-plated steel sheet according to [1] or [2], in which the hot-dip Zn alloy plating layer contains 1.0 to 22.0% by mass of Al, 0.1 to 10.0% by mass of Mg with the balance of Zn and unavoidable impurities.

[4] The method for producing a hot-dip Zn alloy-plated steel sheet according to [3], in which the hot-dip Zn alloy plating layer further contains 0.001 to 2.0% by mass of Si.

[5] The method for producing a hot-dip Zn alloy-plated steel sheet according to [3] or [4], in which the hot-dip Zn alloy plating layer further contains 0.001 to 0.1% by mass of Ti.

[6] The method for producing a hot-dip Zn alloy-plated steel sheet according to any one of [3] to [5], in which the hot-dip Zn alloy plating layer further contains 0.001 to 0.045% by mass of B.

One aspect of the present disclosure relates to a method for producing a hot-dip Zn alloy-plated steel sheet comprising: forming a hot-dip Zn alloy plating layer on a surface of a base steel sheet by immersing the base steel sheet in a hot-dip Zn alloy plating bath containing Al and Mg; and contacting an aqueous solution containing a polyatomic ion including V^{5+} with a surface of the hot-dip Zn alloy plating layer, to thereby cool the substrate steel sheet and the hot-dip Zn alloy plating layer whose temperatures have been increased through formation of the hot-dip Zn alloy plating layer wherein the aqueous

solution contains the polyatomic ion in a concentration of 0.01 g/L or more in terms of atom of V, and a surface temperature of the hot-dip Zn alloy plating layer when the aqueous solution is contacted with the surface of the hot-dip Zn alloy plating layer is 100 °C or above and equal to or less than a solidifying point of the plated layer.

Another aspect relates to a method for producing a hot-dip Zn alloy-plated steel sheet comprising: forming a hot-dip Zn alloy plating layer on a surface of a base steel sheet by immersing the base steel sheet in a hot-dip Zn alloy plating bath containing Al and Mg; and contacting an aqueous solution with a surface of the hot-dip Zn alloy plating layer, the aqueous solution containing one of or two or more of polyatomic ions selected from the group consisting of a polyatomic ion including Si^{4+} and a polyatomic ion including Cr^{6+}, to thereby cool the substrate steel sheet and the hot-dip Zn alloy plating layer whose temperatures have been increased through formation of the hot-dip Zn alloy plating layer, removing all the aqueous solution coating the surface of the hot-dip Zn alloy plating layer, with a squeeze roller, wherein the aqueous solution contains the polyatomic ion in a concentration of 0.01 g/L or more in terms of one of or two or more of atoms selected from the group consisting of Si and Cr, and, a surface temperature of the hot-dip Zn alloy plating layer when the aqueous solution is contacted with the surface of the hot-dip Zn alloy plating layer is 100 °C or above and equal to or less than a solidifying point of the plated layer.

Advantageous Effects of Invention

[0011] According to the present invention, a hot-dip Zn alloy-plated steel sheet having excellent blackening resistance can be easily produced with high productivity.

Brief Description of Drawings

[0012]

CLAIMS

Claim 1 A method for producing a hot-dip Zn alloy-plated steel sheet comprising:

forming a hot-dip Zn alloy plating layer on a surface of a base steel sheet by immersing the base steel sheet in a hot-dip Zn alloy plating bath containing Al and Mg; and

contacting an aqueous solution containing a polyatomic ion including V^{5+} with a surface of the hot-dip Zn alloy plating layer~~, the aqueous solution containing one of or two or more of polyatomic ions selected from the group consisting of a polyatomic ion including V^{5+}, a polyatomic ion including Si^{4+}, and a polyatomic ion including Cr^{6+}~~, to thereby cool the substrate steel sheet and the hot-dip Zn alloy plating layer whose temperatures have been increased through formation of the hot-dip Zn alloy plating layer

wherein the aqueous solution contains the polyatomic ion in a concentration of 0.01 g/L or more in terms of ~~one of or two or more of~~ atoms ~~selected from the group consisting~~ of V, ~~Si,~~ and ~~Cr~~

a surface temperature of the hot-dip Zn alloy plating layer when the aqueous solution is contacted with the surface of the hot-dip Zn alloy plating layer is 100 °C or above and equal to or less than a solidifying point of the plated layer.

Claim 2 A method for producing a hot-dip Zn alloy-plated steel sheet comprising:

forming a hot-dip Zn alloy plating layer on a surface of a base steel sheet by immersing the base steel sheet in a hot-dip Zn alloy plating bath containing Al and Mg; and

contacting an aqueous solution with a surface of the hot-dip Zn alloy plating layer, the aqueous solution containing one of or two or more of polyatomic ions selected from the group consisting of a polyatomic ion including Si^{4+} and a polyatomic ion including Cr^{6+}, to thereby cool the substrate steel sheet and the hot-dip Zn alloy plating layer whose temperatures have been increased through formation of the hot-dip Zn alloy plating layer,

removing all the aqueous solution coating the surface of the hot-dip Zn alloy plating

layer, with a squeeze roller.

wherein the aqueous solution contains the polyatomic ion in a concentration of 0.01 g/L or more in terms of one of or two or more of atoms selected from the group consisting of Si and Cr, and,

a surface temperature of the hot-dip Zn alloy plating layer when the aqueous solution is contacted with the surface of the hot-dip Zn alloy plating layer is 100 °C or above and equal to or less than a solidifying point of the plated layer~~The method for producing a hot-dip Zn alloy-plated steel sheet according to claim 1, wherein a temperature of the surface of the hot-dip Zn alloy plating layer when the aqueous solution is contacted with the surface of the hot-dip Zn alloy plating layer is 100°C or above and equal to or less than a solidifying point of the plating layer~~.

Claim 3 The method for producing a hot-dip Zn alloy-plated steel sheet according to claim 1 or 2, wherein the hot-dip Zn alloy plating layer contains 1.0 to 22.0% by mass of Al, 0.1 to 10.0% by mass of Mg with the balance of Zn and unavoidable impurities.

Claim 4 The method for producing a hot-dip Zn alloy-plated steel sheet according to claim 3, wherein the hot-dip Zn alloy plating layer further contains 0.001 to 2.0% by mass of Si.

Claim 5 The method for producing a hot-dip Zn alloy-plated steel sheet according to

claim 3 or 4, wherein the hot-dip Zn alloy plating layer further contains 0.001 to 0.1% by mass of Ti.

Claim 6 The method for producing a hot-dip Zn alloy-plated steel sheet according to any one of claims 3 ~~claim~~ to 5, wherein the hot-dip Zn alloy plating layer further contains 0.001 to 0.045% by mass of B.