CLAIMS

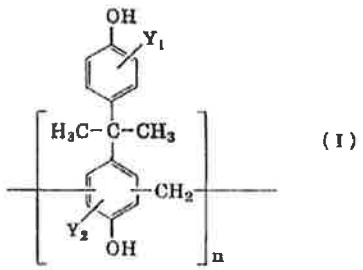
[Claim 1]

A method for producing a hot-dip galvanized steel sheet, the method comprising:

applying a surface treatment agent with a pH of 4 to 5 to a hop-dip galvanized steel sheet having a Ra of 0.5 to 2.0 μm and a PPI of 150 or more; and

drying the surface treatment agent at an ultimate sheet temperature of 50°C to 180°C to form a surface treatment coating film having a coating weight of 0.2 to 1.0 g/m^2 on the surface of the steel sheet, the surface treatment agent containing:

(A) a resin compound having a bisphenol skeleton ~~represented by general formula (I) described below~~(hereinafter referred to as "resin compound (A)") represented by general formula (I);



(I)

in the formula (I), Y_1 and Y_2 bonded to benzene rings are each independently a hydrogen atom or a Z group represented by general formula (II) or (III), the average number of Z groups substituted per benzene ring is 0.2 to 1.0, and n represents an integer of 2 to 50.

(B) a cationic urethane resin emulsion having at least

one cationic functional group selected from primary to tertiary amino groups and quaternary ammonium bases (hereinafter referred to as "cationic urethane (B)");

(C) at least one silane coupling agent having at least one reactive functional group selected from an active hydrogen-containing amino group, an epoxy group, a mercapto group, and a methacryloxy group;

(D) an organic titanium chelate compound;

(E) a tetravalent vanadyl compound; and

(F) water,

wherein the solid content of the cationic urethane (B) is 0.10 to 0.30 in terms of ratio by mass [(b)/{(a) + (b) + (c)}] relative to the total solid content of the resin compound (A), the cationic urethane (B), and the silane coupling agent (C);

the solid content of the silane coupling agent (C) is 0.60 to 0.85 in terms of ratio by mass [(c)/{(a) + (b) + (c)}] relative to the total solid content of the resin compound (A), the cationic urethane (B), and the silane coupling agent (C);

the solid content of the silane coupling agent (C) is 50 to 70 in terms of ratio by mass [(c)/Ti] relative to the content of the organic titanium chelate compound (D) in terms of titanium; and

the content of the tetravalent vanadyl compound (E) in terms of vanadium is 0.30 to 0.50 in terms of ratio by mass (V/Ti) relative to the content of the organic titanium chelate compound (D) in terms of titanium;

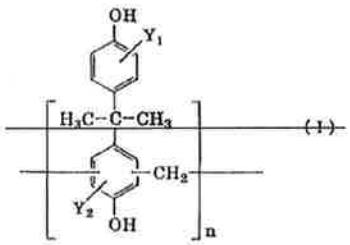
Ra represents arithmetic mean roughness ~~according to JIS B 0601-1994~~, and PPI represents the number of peaks per

25.4 mm (1 inch) ~~according to SAEJ911~~ determined from a roughness curve ~~according to JIS B 0601-1994~~; and

in each of the equations, (a) represents the solid content of the resin compound (A); (b), the solid content of the cationic urethane (B); (c), the solid content of the silane coupling agent (C); Ti, the content of the organic titanium chelate compound (D) in terms of titanium; and V, the content of the tetravalent vanadyl compound (E) in terms of vanadium~~.~~,

~~Note~~

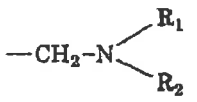
~~[Chem. 1]~~



~~in the formula (I), Y_1 and Y_2 bonded to benzene rings are each independently a hydrogen atom or a Z group represented by general formula (II) or (III) below, the average number of Z groups substituted per benzene ring is 0.2 to 1.0, and n represents an integer of 2 to 50.~~

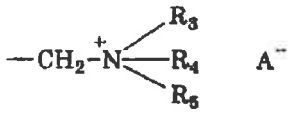
~~Note~~

~~[Chem.2]~~



(II)

~~[Chem. 3]~~



(III)

in the formulae (II) and (III), R_1, R_2, R_3, R_4 and R_5 each independently represent a hydrogen atom, an alkyl group having 1 to 10 carbon atoms, or a hydroxyalkyl group having 1 to 10 carbon atoms, and A^- represents a hydroxide ion or an acid ion.

[Claim 2]

The method for producing a hot-dip galvanized steel sheet according to Claim 1, wherein the surface treatment agent further contains wax (W), and the solid content of the wax (W) is 0.01 to 0.10 in terms of ratio by mass relative to the surface treatment coating film.

[Claim 3]

A hot-dip galvanized steel sheet produced using the method for producing a hot-dip galvanized steel sheet according to Claim 1 or 2.