CLAIMS

[Claim 1] A hot-dip Al-Zn-Si-Mg coated steel sheet comprising

a coating having a composition containing Al: 45 mass% to 65 mass%, Si: 1.0 mass% to 4.0 mass%, and Mg: 1.0 mass% to 10.0 mass% with a balance consisting of Zn and inevitable impurities,

wherein Ni content in the inevitable impurities is 0.010 mass% or less with respect to a total mass of the coating,

a Ni-based compound is contained in the coating, and the number of the Ni-based compound present in a direction parallel to a surface of a base steel sheet is 5 per mm or less,

and respective diffraction intensities of Mg_2Si and $MgZn_2$ in the coating by an X-ray diffraction method satisfy the following relationship (1):

$$Mg_2Si\ (111)/MgZn_2\ (100) \leq 2.0 \quad \ldots (1)$$

where Mg_2Si (111) is a diffraction intensity of (111) plane of Mg_2Si with interplanar spacing d = 0.3668 nm, and $MgZn_2$ (100) is a diffraction intensity of (100) plane of $MgZn_2$ with interplanar spacing d = 0.4510 nm.

[Claim 2] The hot-dip Al-Zn-Si-Mg coated steel sheet according to claim 1, wherein a Ni-based compound is contained in the coating, and a major axis length of the Ni-based compound is 4.0 μm or less.

[Claim 3] The hot-dip Al-Zn-Si-Mg coated steel sheet according to claim 1, wherein a Ni-based compound is not contained in the coating.

[Claim 4] The hot-dip Al-Zn-Si-Mg coated steel sheet according to any one of claims 1 to 3, wherein a diffraction intensity of Si in the coating by an X-ray diffraction method satisfies the following relationship (2):

$$Si\ (111) = 0 \quad \ldots (2)$$

where Si (111) is a diffraction intensity of (111) plane of Si with interplanar spacing d = 0.3135 nm.

[Claim 5] The hot-dip Al-Zn-Si-Mg coated steel sheet according to any one of claims 1 to 4, wherein the coating further contains Sr: 0.01 mass% to 1.0 mass%.

[Claim 6] The hot-dip Al-Zn-Si-Mg coated steel sheet according to any one of claims 1 to 5, wherein Al content in the coating is 50 mass% to 60 mass%.

[Claim 7] The hot-dip Al-Zn-Si-Mg coated steel sheet according to any one of claims 1 to 6, wherein Si content in the coating is 1.0 mass% to 3.0 mass%.

[Claim 8] The hot-dip Al-Zn-Si-Mg coated steel sheet according to any one of claims 1 to 7, wherein Mg content in the coating is 1.0 mass% to 5.0 mass%.

[Claim 9] A production method for a hot-dip Al-Zn-Si-Mg coated steel sheet that includes a coating, the production method comprising

a hot-dip coating treatment process of immersing a base steel sheet in a molten bath having a composition containing Al: 45 mass% to 65 mass%, Si: 1.0 mass% to 4.0 mass%, and Mg: 1.0 mass% to 10.0 mass% with a balance consisting of Zn and inevitable impurities, to form the coating,

wherein Ni content in the inevitable impurities in the molten bath is controlled to be 0.010 mass% or less with respect to a total mass of the molten bath,

a Ni-based compound is contained in the coating, and the number of the Ni-based compound present in a direction parallel to a surface of a base steel sheet is 5 per mm or less,

and respective diffraction intensities of Mg_2Si and $MgZn_2$ in the coating by an X-ray diffraction method satisfy the following relationship (1):

$$Mg_2Si\ (111)/MgZn_2\ (100) \leq 2.0 \quad \ldots (1)$$

where Mg_2Si (111) is a diffraction intensity of (111) plane of Mg_2Si with interplanar spacing d = 0.3668 nm, and $MgZn_2$ (100) is a diffraction intensity of (100) plane of $MgZn_2$ with interplanar spacing d = 0.4510 nm.

[Claim 10] The production method for a hot-dip Al-Zn-Si-Mg coated steel sheet according to claim 9, wherein the molten bath further contains Sr: 0.01 mass% to 1.0 mass%.

[Claim 11] A surface-treated steel sheet comprising:

the coating according to any one of claims 1 to 8; and

a chemical conversion layer formed on the coating,

wherein the chemical conversion layer contains: at least one resin selected from the group consisting of an epoxy resin, a urethane resin, an acrylic resin, an acrylic silicon resin, an alkyd resin, a polyester resin, a polyalkylene resin, an amino resin, and a fluororesin; and at least one metallic compound selected from the group consisting of a P compound, a Si compound, a Co compound, a Ni compound, a Zn compound, an Al compound, a Mg compound, a V compound, a Mo compound, a Zr compound, a Ti compound, and a Ca compound.

[Claim 12] A production method for a surface-treated steel sheet that includes: a coating formed by the production method for a hot-dip Al-Zn-Si-Mg coated steel sheet according to claim 9 or 10; and a chemical conversion layer formed on the coating,

wherein the chemical conversion layer contains: at least one resin selected from the group consisting of an epoxy resin, a urethane resin, an acrylic resin, an acrylic silicon resin, an alkyd resin, a polyester resin, a polyalkylene resin, an amino resin, and a fluororesin; and at least one metallic compound selected from the group consisting of a P compound, a Si compound, a Co compound, a Ni compound, a Zn compound, an Al compound, a Mg compound, a V compound, a Mo compound, a Zr compound, a Ti compound, and a Ca compound.

[Claim 13] A painted steel sheet comprising:

the coating according to any one of claims 1 to 8; and

a painting layer formed on the coating directly or with a chemical conversion layer therebetween,

wherein the chemical conversion layer contains: a resin component that contains (a): an anionic polyurethane resin having an ester bond and (b): an epoxy resin having a bisphenol skeleton in a total amount of 30 mass% to 50 mass% and in which a content ratio (a):(b) between (a) and (b) is in a range of 3:97 to 60:40 in mass ratio; and an inorganic compound that contains 2 mass% to 10 mass% of a vanadium compound, 40 mass% to 60 mass% of a zirconium compound, and 0.5 mass% to 5 mass% of a fluorine compound, and

the painting layer includes at least a primer painting layer that contains: a polyester resin having a urethane bond; and an inorganic compound including a vanadium compound, a phosphate compound, and magnesium oxide.

[Claim 14] A production method for a painted steel sheet that includes: a coating formed by the production method for a hot-dip Al-Zn-Si-Mg coated steel sheet according to claim 9 or 10; and a painting layer formed on the coating directly or with a chemical conversion layer therebetween,

wherein the chemical conversion layer contains: a resin component that contains (a): an anionic polyurethane resin having an ester bond and (b): an epoxy resin having a bisphenol skeleton in a total amount of 30 mass% to 50 mass% and in which a content ratio (a):(b) between (a) and (b) is in a range of 3:97 to 60:40 in mass ratio; and an inorganic compound that contains 2 mass% to 10 mass% of a vanadium compound, 40 mass% to 60 mass% of a zirconium compound, and 0.5 mass% to 5 mass% of a fluorine compound, and

the painting layer includes at least a primer painting layer that contains: a polyester resin having a urethane bond; and an inorganic compound including a vanadium compound, a phosphate compound, and magnesium oxide.