CLAIMS

Claim 1

A surface-treated steel sheet comprising:

a steel sheet;

a plated layer that contains zinc and is formed on the steel sheet; and

a coating formed on the plated layer,

wherein the coating contains an acrylic resin, zirconium, vanadium, phosphorus and cobalt,

the acrylic resin has an area ratio of 80 to 100 area% in an area from a surface of the coating to a thickness of one-fifth of a film thickness of the coating on a cross-section, and

the acrylic resin has an area ratio of 5 to 50 area% in an area including an area from the film thickness center of the coating to a thickness of one-tenth of the film thickness toward the surface side and an area from the film thickness center to a thickness of one-tenth of the film thickness toward the plated layer side.

Claim 2

The surface-treated steel sheet according to claim 1, wherein

a plurality of island projections is present on the surface of the coating in a planar view, and

when three or more virtual straight lines each having a length of equal to or more than 10 μm and extending in any direction are drawn on any positions on the surface of the coating in a planar view, a length of each projection is 0.1 to 5.0 μm, where the length of each projection is defined as an average value of lengths of a plurality of line segments, which are portions of the virtual straight lines passing through the projections.

Claim 3

The surface-treated steel sheet according to claim 2, wherein the surface of the coating in a rectangular area of 1 μm on one side has an arithmetic mean roughness Ra of 5 to 50 nm, a maximum cross-sectional height Rt of a roughness

curve of 50 to 500 nm, and a root mean square roughness Rq of 10 to 100 nm.

Claim 4

The surface-treated steel sheet according to claim 2 or 3, wherein a concentration of the zirconium in an area between adjacent projections in the coating is less than a concentration of the zirconium in an area on which the projections are formed.

Claim 5

The surface-treated steel sheet according to any one of claims 2 to 4, wherein a concentration of the acrylic resin in an area between adjacent projections in the coating is more than a concentration of the acrylic resin in an area on which the projections are formed.

Claim 6

The surface-treated steel sheet according to any one of claims 1 to 5, wherein

the coating has a mass ratio of a mass of the vanadium to a mass of the zirconium of 0.07 to 0.69,

a mass ratio of a mass of the phosphorus to the mass of the zirconium of 0.04 to 0.58, and

a mass ratio of a mass of the cobalt to the mass of the zirconium of 0.005 to 0.08.

Claim 7

The surface-treated steel sheet according to any one of claims 1 to 6, wherein the zirconium is contained in the coating by 4 to 400 mg/m^2 in terms of metal.

Claim 8

The surface-treated steel sheet according to any one of claims 1 to 7,