CLAIMS

What is claimed is:

1. A surface-treated steel sheet comprising:

a steel sheet;

a Zn-based plating layer formed on the steel sheet; and

a coating formed on the Zn-based plating layer,

wherein a Si concentration, a P concentration, a F concentration, a V concentration, a Zr concentration, a Zn concentration, and an Al concentration of the coating are, by mass%,

Si: 10.00% to 25.00%,

P: 0.01% to 5.00%,

F: 0.01% to 2.00%,

V: 0.01% to 4.00%,

Zr: 0.01% to 3.00%,

Zn: 0.01% to 3.00%, and

Al: 0% to 3.00%,

in a narrow spectrum of Si2p obtained by performing XPS analysis on a surface of the coating, a ratio of an integrated intensity of a peak having a local maximum value at 103.37 ± 0.25 eV to an integrated intensity of a peak having a local maximum value at 102.26 ± 0.25 eV is 0.04 or more and 0.25 or less.

2. The surface-treated steel sheet according to claim 1,

wherein, in the surface of the coating, the Zn concentration is 0.10% to 3.00% by mass%.

3. The surface-treated steel sheet according to claim 1 or 2,

wherein, in the surface of the coating, the Al concentration is 0.10% to 3.00%

by mass%.

4. The surface-treated steel sheet according to any one of claims 1 to 3,

wherein the coating has a P-enriched layer having a P concentration higher than an average P concentration in a range from the surface of the coating to an interface between the coating and the Zn-based plating layer in a thickness direction of the steel sheet,

the P-enriched layer is present adjacent to the interface with the Zn-based plating layer, and

when line analysis of TEM-EDS is performed on a cross section in the thickness direction to obtain the P concentration from the surface of the coating to the interface between the coating and the Zn-based plating layer, a ratio of a maximum value of the P concentration to the average P concentration is 1.20 to 2.00.

5. The surface-treated steel sheet according to any one of claims 1 to 4,

wherein the coating has a F-enriched layer having a F concentration higher than an average F concentration in a range from the surface of the coating to an interface between the coating and the Zn-based plating layer in a thickness direction of the steel sheet,

the F-enriched layer is present adjacent to the interface with the Zn-based plating layer, and

when line analysis of TEM-EDS is performed on a cross section in the thickness direction to obtain the F concentration from the surface of the coating to the interface between the coating and the Zn-based plating layer, a ratio of a maximum value of the F concentration to the average F concentration is 1.50 to 2.30.

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

wherein the Zn-based plating layer contains, as a chemical composition, by

mass%,

Al: 4.0% to less than 25.0%,

Mg: 0% to less than 12.5%,

Sn: 0% to 20%,

Bi: 0% to less than 5.0%,

In: 0% to less than 2.0%,

Ca: 0% to 3.0%,

Y: 0% to 0.5%,

La: 0% to less than 0.5%,

Ce: 0% to less than 0.5%,

Si: 0% to less than 2.5%,

Cr: 0% to less than 0.25%,

Ti: 0% to less than 0.25%,

Ni: 0% to less than 0.25%,

Co: 0% to less than 0.25%,

V: 0% to less than 0.25%,

Nb: 0% to less than 0.25%,

Cu: 0% to less than 0.25%,

Mn: 0% to less than 0.25%,

Fe: 0% to 5.0%,

Sr: 0% to less than 0.5%,

Sb: 0% to less than 0.5%,

Pb: 0% to less than 0.5%,

B: 0% to less than 0.5%, and

a remainder: Zn and impurities.