CLAIMS

[Claim 1]

A heat exchanger formed of a cobalt based alloy, the cobalt based alloy having a chemical composition comprising:

0.08 to 0.25 mass % of carbon;

0.1 mass % or less of boron;

10 to 30 mass % of chromium;

5 mass % or less of iron, 30 mass % or less of nickel, the total amount of the iron and the nickel being 30 mass % or less;

tungsten and/or molybdenum, the total amount of the tungsten and the molybdenum being 5 to 12 mass %;

titanium, zirconium, niobium and tantalum, the total amount of the titanium, the zirconium, the niobium and the tantalum being 0.5 to 2 mass %;

0.5 mass % or less of silicon;

0.5 mass % or less of manganese;

0.003 to 0.04 mass % of nitrogen; and

the balance being cobalt and impurities, the impurities including 0.5 mass % or less of aluminum, and 0.04 mass % or less of oxygen,

wherein the heat exchanger is a polycrystalline body of matrix phase crystal grains with an average crystal grain size of 5 to 100 μm, and

wherein in the matrix phase crystal grains of the polycrystalline body, segregation cells with an average size of 0.13 to 2 μm are formed, in which components constituting an MC type carbide phase comprising the titanium, the zirconium, the niobium and/or the tantalum are segregated in boundary regions of the segregation cells.

[Claim 2]

The heat exchanger according to claim 1, wherein

grains of the MC type carbide phase are precipitated on the boundary regions of the

segregation cells.

[Claim 3]

The heat exchanger according to claim 1 or 2, wherein

the chemical composition comprises:

0.01 to 1 mass % of the titanium,

0.05 to 1.5 mass % of the zirconium,

0.02 to 1 mass % of the niobium, and

0.05 to 1.5 mass % of the tantalum.

[Claim 4]

A heat exchanger formed of a cobalt based alloy, the cobalt based alloy having a chemical composition comprising:

0.08 to 0.25 mass % of carbon;

0.1 mass % or less of boron;

10 to 30 mass % of chromium;

5 mass % or less of iron, 30 mass % or less of nickel, the total amount of the iron and the nickel being 30 mass % or less;

tungsten and/or molybdenum, the total amount of the tungsten and the molybdenum being 5 to 12 mass %;

titanium, zirconium, niobium and tantalum, the total amount of the titanium, the zirconium, the niobium and the tantalum being 0.5 to 2 mass %;

0.5 mass % or less of silicon;

0.5 mass % or less of manganese;

0.003 to 0.04 mass % of nitrogen; and

the balance being cobalt and impurities, the impurities including 0.5 mass % or less of aluminum, and 0.04 mass % or less of oxygen,

wherein the heat exchanger is a polycrystalline body of matrix phase crystal grains

with an average crystal grain size of 20 to 150 μm, and

wherein in the matrix phase crystal grains of the polycrystalline body, grains of an MC type carbide phase comprising the titanium, the zirconium, the niobium and/or the tantalum are precipitated at an average intergrain distance of 0.13 to 2 μm.

[Claim 5]

The heat exchanger according to claim 4, wherein

the chemical composition comprises:

0.01 to 1 mass % of the titanium,

0.05 to 1.5 mass % of the zirconium,

0.02 to 1 mass % of the niobium, and

0.05 to 1.5 mass % of the tantalum.

[Claim 6]

The heat exchanger according to claim 4 or 5, wherein

the heat exchanger exhibits a 0.2% proof stress of 450 MPa or more at room temperature and a creep temperature endurable for 100,000 hours at a stress of 58 MPa being 875°C or higher.