CLAIMS

[Claim 1]

A product 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 %;

at least one of titanium, zirconium, hafnium, vanadium, niobium and tantalum, the total amount of the titanium, the zirconium, the hafnium, the vanadium, 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 product is a polycrystalline body of matrix phase crystal grains, and

wherein in the polycrystalline body MC type carbide phase grains and $M_{23}C_6$ type carbide phase grains are co-precipitated, the MC type carbide phase grains being dispersively precipitated in the matrix phase crystal grains at an average intergrain distance of 0.13 to 2 μm, the $M_{23}C_6$ type carbide phase grains being precipitated on grain boundaries of the matrix phase crystal grains.

[Claim 2]

The product according to claim 1, wherein:

the MC type carbide phase grains are grains of an MC type carbide phase comprising the titanium, the zirconium, the hafnium, the vanadium, the niobium and/or the tantalum; and

the $M_{23}C_6$ type carbide phase grains are grains of an $M_{23}C_6$ type carbide phase comprising the chromium, the iron, the tungsten, the molybdenum and/or the manganese.

[Claim 3]

The product according to claim 1 or 2, wherein:

in the case that the chemical composition includes the titanium, content of the titanium is 0.01 to 1 mass %;

in the case that the chemical composition includes the zirconium, content of the zirconium is 0.05 to 1.5 mass %;

in the case that the chemical composition includes the hafnium, content of the hafnium is 0.01 to 0.5 mass %;

in the case that the chemical composition includes the vanadium, content of the vanadium is 0.01 to 0.5 mass %;

in the case that the chemical composition includes the niobium, content of the niobium is 0.02 to 1 mass %; and

in the case that the chemical composition includes the tantalum, content of the tantalum is 0.05 to 1.5 mass %.

[Claim 4]

The product according to any one of claims 1 to 3, wherein

the product exhibits a creep rupture time of 1,200 hours or more by a creep test under conditions of a temperature of 850°C and a stress of 168 MPa.

[Claim 5]

The product according to any one of claims 1 to 4, wherein

the product is a high temperature member.

[Claim 6]

The product according to claim 5, wherein

the high temperature member is a turbine stator blade, a turbine rotor blade, a turbine combustor nozzle, or a heat exchanger.

[Claim 7]

A method for manufacturing the cobalt based alloy product according to any one of claims 1 to 6, the method comprising:

an alloy powder preparation step of preparing a cobalt based alloy powder having the chemical composition, the cobalt based alloy powder having a particle size;

a selective laser melting step of forming an additively manufactured article, the step comprising alternate repetition of an alloy powder bed preparation substep of laying the cobalt based alloy powder such that it forms an alloy powder bed having a predetermined thickness and a laser melting solidification substep of irradiating a predetermined region of the alloy powder bed with a laser beam to locally melt and rapidly solidify the cobalt based alloy powder in the region, the laser beam having an output power and a scanning speed;

a first heat treatment step of subjecting the additively manufactured article to a first heat treatment at a temperature ranging of 750°C or more and less than 1,100°C; and

a second heat treatment step of subjecting the first heat-treated article to a second heat treatment at a temperature ranging from 600°C to 1,000°C but less than the temperature of the first heat treatment,

wherein in the a selective laser melting step, the predetermined thickness of the alloy powder bed h (unit: μm), the output power of the laser beam P (unit: W), and the scanning speed of the laser beam S (unit: mm/s) are controlled to satisfy the following formulas: “$15 < h < 150$” and “$67 \times (P/S) - 3.5 < h < 2222 \times (P/S) + 13$”.

[Claim 8]

The method for manufacturing the cobalt based alloy product according to claim 7, wherein

the alloy powder preparation step comprises an alloy powder classification substep of regulating the particle size of the cobalt based alloy powder to 5 to 100 μm.