phase, the regions of the magnetic phase are separated from each other by the oxide phase, and the regions of the non-magnetic phases are separated from each other by the oxide phase.

[0006]

These magnetron sputtering targets allow an increased amount of leakage magnetic flux to flow from the surfaces of the targets during magnetron sputtering without reducing the amount of Co, or a ferromagnetic metal element, contained in the targets, so that magnetron sputtering can be performed favorably.

CITATION LIST

Patent Literature

[0007]

Patent Literature 1: Japanese Patent No. 4422203

Patent Literature 2: Japanese Patent No. 4871406

SUMMARY ~~OF INVENTION~~

Technical Problem

[0008]

It can be generally said of sputtering that generation of defects such as nodules and particles needs to be minimized during sputtering. This requirement is also applied to magnetron sputtering.

[0009]

The present ~~invention~~ disclosure has been made in light of such a point. An object of the present ~~invention~~ disclosure is to provide a target for magnetron sputtering in which the leakage magnetic flux during magnetron sputtering is kept high without a reduction in the Co content contained in the target, and in which generation of defects such as nodules and particles is unlikely to occur, and a manufacturing method for the target for magnetron sputtering.

Solution to Problem

[0010]

The present disclosure relates to ~~A first aspect of a target for magnetron sputtering according to the present invention is~~ a target for magnetron sputtering, comprising metal Co, metal Cr, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at% and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%; and a magnetic metal phase containing metal Co, wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, wherein the non-magnetic metal phase and the oxide are mutually dispersed, and wherein no aggregated oxide having a

longest diameter of 5 μm or larger is present.

[0011]

The present disclosure also ~~describes~~ relates to ~~A second aspect of a target for magnetron sputtering according to the present invention is~~ a target for magnetron sputtering, comprising metal Co, metal Cr, metal Pt, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at% and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%; and a magnetic metal phase containing metal Co, wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, wherein the non-magnetic metal phase and the oxide are mutually dispersed, and wherein no aggregated oxide having a longest diameter of 5 μm or larger is present.

[0012]

A ~~third~~ first aspect of a target for magnetron sputtering according to the present ~~invention~~ disclosure is a target for magnetron sputtering, comprising metal Co, metal Cr, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at % and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co and metal Cr with an atomic ratio of the

metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less; and a magnetic metal phase containing metal Co, wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, and wherein the non-magnetic metal phase and the oxide are mutually dispersed.

[0013]

A ~~fourth~~ second aspect of a target for magnetron sputtering according to the present ~~invention~~ disclosure is a target for magnetron sputtering, comprising metal Co, metal Cr, metal Pt, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at % and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less; and a magnetic metal phase containing metal Co, wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, and wherein the non-magnetic metal phase and the oxide are mutually dispersed.

[0014]

entire target to increase the leakage magnetic flux from the target surface.

[0021]

It is more preferable that the magnetic metal phases be free of Cr and the magnetic metal phases be magnetic metal phase consisting of metal Co and unavoidable impurities in order to reduce the magnetism as the entire target to increase the leakage magnetic flux from the target surface.

[0022]

For example, the oxide may contain at least one of SiO_2, TiO_2, Ti_2O_3, Ta_2O_5, Cr_2O_3, CoO, Co_3O_4, B_2O_3, Fe_2O_3, CuO, Y_2O_3, MgO, Al_2O_3, ZrO_2, Nb_2O_5, MoO_3, CeO_2, Sm_2O_3, Gd_2O_3, WO_2, WO_3, HfO_2, and NiO_2.

[0023]

Since any of the targets contains ferromagnetic metal element Co, some of the targets can be suitably used for forming a magnetic recording layer having excellent magnetic recording characteristics.

[0024]

~~The first aspect of a~~A target for magnetron sputtering according to the present ~~invention~~ disclosure can be manufactured by, for example, a manufacturing method for a target for magnetron sputtering, the method comprising the steps of: mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal

powder containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%, the non-magnetic metal powder being produced by atomizing method and being classified to have a particle size of 106 μm or smaller, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder; mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and pressure sintering the obtained powder mixture for pressure sintering, wherein no aggregated oxide having a longest diameter of 5 μm or larger is present in the obtained sintered product.

[0025]

~~The second aspect of a~~ A target for magnetron sputtering according to the present ~~invention~~ disclosure can also be manufactured by, for example, a manufacturing method for a target for magnetron sputtering, the method comprising the steps of: mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%, the non-magnetic metal powder being produced by atomizing method and being classified to have a particle size of 106 μm or

smaller, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder; mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and pressure sintering the obtained powder mixture for pressure sintering, wherein no aggregated oxide having a longest diameter of 5 μm or larger is present in the obtained sintered product.

[0026]

The ~~third~~ first aspect of a target for magnetron sputtering according to the present ~~invention~~ disclosure can be manufactured by, for example, a manufacturing method for a target for magnetron sputtering, the method comprising the steps of: mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder; mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a

powder mixture for pressure sintering; and pressure sintering the obtained powder mixture for pressure sintering.

[0026a]

A third aspect of the present disclosure provides a manufacturing method for a target for magnetron sputtering, the method comprising the steps of:

mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder;

mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and

pressure sintering the obtained powder mixture for pressure sintering.

[0027]

The ~~fourth~~ second aspect of a target for magnetron sputtering according to the present ~~invention~~ disclosure can be manufactured by, for example, a manufacturing method for a

target for magnetron sputtering, the method comprising the steps of: mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder; mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and pressure sintering the obtained powder mixture for pressure sintering.

[0027a]

A fourth aspect of the present disclosure provides a manufacturing method for a target for magnetron sputtering, the method comprising the steps of:

mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total

of the metal Co and the other metals being more than 0 at% and 45 at% or less, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder;

mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and pressure sintering the obtained powder mixture for pressure sintering.

[0028]

Herein, the "magnetic metal powder" is a powder with magnetism (except for powders with magnetism sufficiently lower than the magnetism of ordinary magnetic substances), and the "non-magnetic powders" are a concept including not only

and unavoidable impurities in order to reduce the magnetism as the entire target to be produced to increase the leakage magnetic flux from the target surface.

[0033]

For example, the oxide used in the above-described manufacturing method may contain at least one of SiO_2, TiO_2, Ti_2O_3, Ta_2O_5, Cr_2O_3, CoO, Co_3O_4, B_2O_3, Fe_2O_3, CuO, Y_2O_3, MgO, Al_2O_3, ZrO_2, Nb_2O_5, MoO_3, CeO_2, Sm_2O_3, Gd_2O_3, WO_2, WO_3, HfO_2, and NiO_2.

[0034]

The present disclosure also relates to ~~fifth aspect of~~ a target for magnetron sputtering ~~according to the present invention is a target~~ obtained by the above-described manufacturing method.

Advantageous Effects ~~of Invention~~

[0035]

The present ~~invention~~ disclosure can provide a target for magnetron sputtering in which the leakage magnetic flux during magnetron sputtering is kept high without a reduction in the Co content contained in the target, and in which generation of defects such as nodules and particles is unlikely to occur, and a method for producing the target for magnetron sputtering.

BRIEF DESCRIPTION OF DRAWINGS

[0036]

FIG. 1 is a graph showing the relationship between the

cross section in the thickness direction of a sintered test piece according to Comparative Example 2 (produced using the magnetic powder mixture mixed until the cumulative number of ball mill revolutions reached 2,988,000) at low magnification (an image taken at a magnification of 400x; a bar scale in the photograph represents 100 μm).

FIG. 18 is a metallurgical microscope photograph of the cross section in the thickness direction of a sintered test piece according to Comparative Example 2 (produced using the magnetic powder mixture mixed until the cumulative number of ball mill revolutions reached 3,906,000) at high magnification (an image taken at a magnification of 400x; a bar scale in the photograph represents 100 μm).

DESCRIPTION OF EMBODIMENTS

[0037]

A first ~~aspect~~ embodiment of a target for magnetron sputtering according to the present invention is a target for magnetron sputtering, comprising metal Co, metal Cr, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at% and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%; and a magnetic metal

phase containing metal Co, wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, wherein the non-magnetic metal phase and the oxide are mutually dispersed, and wherein no aggregated oxide having a longest diameter of 5 μm or larger is present.

[0038]

A second embodiment ~~aspect~~ of a target for magnetron sputtering according to the present invention is a target for magnetron sputtering, comprising metal Co, metal Cr, metal Pt, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at% and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%; and a magnetic metal phase containing metal Co, wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, wherein the non-magnetic metal phase and the oxide are mutually dispersed, and wherein no aggregated oxide having a longest diameter of 5 μm or larger is present.

[0039]

In both the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention, the atomic ratio of metal Cr to the total of metal Co and metal Cr

is more than 0 at% and less than 25 at% in the composition of the entire target. Therefore, if the target includes one type of metal phase, the atomic ratio of metal Cr to the total of metal Co and metal Cr in the metal phase will naturally be more than 0 at% and less than 25 at% (the atomic ratio of metal Co to the total of metal Co and metal Cr is 75 at% or more and less than 100 at%). With this atomic ratio, the metal phase in the target will be a magnetic phase, as described below, so that the leakage magnetic flux from the target surface is reduced during magnetron sputtering.

[0040]

In both the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention, the target for magnetron sputtering includes a non-magnetic metal phase having an atomic ratio of metal Cr to the total of metal Co and the metal Cr of 25 at% or more and less than 100 at% and a magnetic metal phase containing metal Co. As more Co is contained in the magnetic metal phase, less Co is contained in the other metal phase, so that the atomic ratio of metal Cr to the total of metal Co and the metal Cr is 25 at% or more and less than 100 at% in the other metal phase. As a result, substantially zero magnetism of the other metal phase is achieved (the reason of substantially zero magnetism will be described below).

[0041]

In other words, in the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention, the atomic ratio of metal Cr to the total of metal Co and metal Cr is more than 0 at% and less than 25 at% in the composition of the entire target, while the atomic ratio of metal Cr to the total of metal Co and metal Cr is 25 at% or more and less than 100 at% in the composition of the non-magnetic metal phase. This atomic ratio causes substantially zero magnetism of the non-magnetic metal phase to reduce the magnetism as the entire target with a constant content of metal Co in the entire target.

[0042]

This increases the leakage magnetic flux from the target surface during magnetron sputtering to enable favorable magnetron sputtering in both the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention.

[0043]

In both the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention, the volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less. Because of this, the volume ratio of the oxide powder to the non-magnetic metal powder is as small as 1.2 or less in terms of the non-magnetic metal powder and oxide powder that constitute a powder mixture for target

production. This volume ratio facilitates good mixing of the non-magnetic metal powder and the oxide powder in the production of the powder mixture for target production (on the other hand, too much volume of the oxide powder to the non-magnetic metal powder easily causes poor mixing of the non-magnetic metal powder and the oxide powder). As a result, the non-magnetic metal phase and the oxide can be mutually dispersed in both the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention. Also, the non-magnetic metal phase and the oxide easily form a structure in which they are finely dispersed in each other.

[0044]

In Comparative Example 2 described below in the section of [Examples], however, the volume ratio of the oxide powder to the non-magnetic metal powder was 1.2 or less in terms of the non-magnetic metal powder and oxide powder that constitute a powder mixture for target production, but aggregated oxides having a major axis of 5 μm or larger were found in the obtained target. It is considered that even if the volume ratio of the oxide powder to the non-magnetic metal powder is 1.2 or less in terms of the non-magnetic metal powder and oxide powder that constitute a powder mixture for target production, good mixing of the metal powder and the oxide would not be achieved depending on the composition of the metal powder constituting the powder mixture for target

production, and aggregated oxides having a longest diameter of 5 μm or larger may be found in the obtained target. Because of this, the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention have an additional constitutional requirement that the target for magnetron sputtering is free of aggregated oxides having a longest diameter of 5 μm or larger. Thus, targets containing aggregated oxides having a longest diameter of 5 μm or larger are excluded from the first and second aspects of the target for magnetron sputtering according to the present invention.

[0045]

Next, the reason that the atomic ratio of metal Cr to the total of metal Co and metal Cr is 25 at% or more and less than 100 at% in the non-magnetic metal phase in the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention will be described.

[0046]

TABLE 1 below shows the experimental results of the measurement of the tensile stresses of Co-Cr alloys with different ratios of amounts of Co. The tensile stress is used as a measure for evaluation of magnetism (the larger the value of the tensile stress, the larger the magnetism, as described later). FIG. 1 is a graph based on TABLE 1 below and showing the relationship between the ratio of the amount of Co in the Co-Cr alloy and its magnetism. The horizontal axis represents

the ratio of the amount of Co, and the vertical axis represents the tensile stress used as the measure of evaluation of magnetism.

[0047]

[TABLE 1]

Ratio of amount of Co (at%)	Ratio of amount of Cr (at%)	Tensile stress (Pa)
0	100	0.0
50	50	0.0
70	30	0.0
75	25	1.1
76	24	11.2
77	23	26.2
78	22	44.6
79	21	54.6
80	20	79.5
81	19	110.4
82	18	147.4
83	17	165.3
85	15	169.9
87	13	164.1
90	10	172.4
100	0	172.8

[0048]

Table 1 and Fig. 1 show that the magnetism of the Co-Cr alloy is substantially zero when the Cr content ratio is 25 at% or more (the Co content ratio is 75 at% or less) in the Co-Cr alloy. In the non-magnetic metal phase in the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention, the atomic ratio of metal Cr to the total of metal Co and metal Cr is 25 at% or more and

target). Thus, particularly large effects can be obtained by applying the present invention to targets having a large metal Co content (a small metal Cr content) in the entire targets (for example, targets for magnetron sputtering that have an atomic ratio of metal Cr to the total of metal Co and the metal Cr of less than 20 at%).

[0053]

Table 1 and Fig. 1 also show that the magnetism of the non-magnetic metal phase can be substantially zero when the atomic ratio of metal Cr to the total of metal Co and metal Cr is 30 at% or more. Thus, the atomic ratio of metal Cr to the total of metal Co and metal Cr is preferably 30 at% or more in the non-magnetic metal phase in the first and second embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention.

[0054]

The data in TABLE 1 and FIG. 1 were measured as follows specifically. Co and Cr were prepared in a volume of 1 cm^3 and arc-melted to produce disk-shaped samples having a bottom area of 0.785 cm^2 with different compositions. The bottom surface of one of the disk-shaped samples was attached to a magnet (formed of ferrite) having a residual magnetic flux density of 500 Gauss. Then the sample was pulled in a direction perpendicular to the bottom surface, and a force when the sample was detached from the magnet was measured. Since a

tensile stress determined by dividing the measured force by the bottom surface area 0.785 cm^2 is positively correlated with the magnetism of the sample, the tensile stress was used as the measure for evaluation of magnetism. Table 1 describes the values of the tensile stress as a function of the composition ratio. In the graph of Fig. 1, the tensile stress is taken along the vertical axis, and the Co content ratio is taken along the horizontal axis.

[0055]

Next, third and fourth embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention will be described.

[0056]

A third embodiment ~~aspect~~ of a target for magnetron sputtering according to the present invention is a target for magnetron sputtering, comprising metal Co, metal Cr, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at % and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 70 at% or less; and a magnetic metal phase containing metal Co, wherein a volume

ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, and wherein the non-magnetic metal phase and the oxide are mutually dispersed.

[0057]

A fourth embodiment ~~aspect~~ of a target for magnetron sputtering according to the present invention is a target for magnetron sputtering, comprising metal Co, metal Cr, metal Pt, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at % and less than 25 at%, wherein the target comprises: a non-magnetic metal phase containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 70 at% or less; and a magnetic metal phase containing metal Co, wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, and wherein the non-magnetic metal phase and the oxide are mutually dispersed.

[0058]

The non-magnetic metal phase in the third and fourth embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention is the same as those in the first and second embodiments ~~aspects~~ in that the atomic ratio of metal Cr to the total of metal Co and metal Cr is 25 at% or more and less than

100 at%. The non-magnetic metal phase in the third and fourth embodimentsaspects, however, has an additional constituent feature that the atomic ratio of metal Co to the total of the metal Co and the other metals is more than 0 at% and 70 at% or less. As demonstrated in [Examples] described below, the non-magnetic metal powder is easily mixed well with the oxide powder to substantially prevent aggregated oxides in the obtained target when the atomic ratio of metal Co to the total of the metal Co and the other metals is 70 at% or less in the non-magnetic metal powder constituting a powder mixture for target production.

[0059]

The atomic ratio of metal Co to the total of the metal Co and the other metals is preferably 50 at% or less in the non-magnetic metal powder constituting a powder mixture for target production in order to decrease the possibility of presence of aggregated oxides in the obtained target and to reduce the number and size of the aggregated oxides if present.

[0060]

The third and fourth embodiments aspects of the target for magnetron sputtering according to the present invention also have the same constituent feature as in the first and second aspects that the volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less. Because of this, the volume ratio of the oxide powder to the non-magnetic metal

powder is as small as more than 0 and 1.2 or less in terms of the non-magnetic metal powder and oxide powder that constitute a powder mixture for target production. This volume ratio facilitates good mixing of the non-magnetic metal powder and the oxide powder in the production of the powder mixture for target production (too much volume of the oxide powder to the non-magnetic metal powder easily causes poor mixing of the non-magnetic metal powder and the oxide powder).

[0061]

As mentioned above, in both the third and fourth embodiments ~~aspects~~ of the target for magnetron sputtering according to the present invention, the non-magnetic metal phase and the oxide can be mutually dispersed, and thus the non-magnetic metal phase and the oxide easily form a structure in which they are finely dispersed in each other. That is, aggregation of the oxides can be substantially prevented in the target.

[0062]

Next, a Co-Cr-Pt-SiO_2-Cr_2O_3 target, which can be preferably used for preparing a magnetic recording layer, will be specifically described below as an example of embodiment of the present invention. Although the non-magnetic metal phase in the target of this embodiment contains Pt, Pt in the non-magnetic metal phase is not essential and Pt may not be contained in the non-magnetic metal phase.

[0063]

CLAIMS

1. A target for magnetron sputtering, comprising metal Co, metal Cr, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at% and less than 25 at%,

wherein the target comprises:

a non-magnetic metal phase containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%; and

a magnetic metal phase containing metal Co,

wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less,

wherein the non-magnetic metal phase and the oxide are mutually dispersed, and

wherein no aggregated oxide having a longest diameter of 5 μm or larger is present.

2. A target for magnetron sputtering, comprising metal Co, metal Cr, metal Pt, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at% and less than 25 at%,

wherein the target comprises:

a non-magnetic metal phase containing metal Co,

~~metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%; and~~

~~a magnetic metal phase containing metal Co,~~

~~wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less,~~

~~wherein the non-magnetic metal phase and the oxide are mutually dispersed, and~~

~~wherein no aggregated oxide having a longest diameter of 5 μm or larger is present.~~

CLAIMS

~~3~~1. A target for magnetron sputtering, comprising metal Co, metal Cr, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at % and less than 25 at%,

wherein the target comprises:

a non-magnetic metal phase containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less; and

a magnetic metal phase containing metal Co,

wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, and

wherein the non-magnetic metal phase and the oxide are mutually dispersed.

42. A target for magnetron sputtering, comprising metal Co, metal Cr, metal Pt, and an oxide with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being more than 0 at % and less than 25 at%,

wherein the target comprises:

a non-magnetic metal phase containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less; and

a magnetic metal phase containing metal Co,

wherein a volume ratio of the oxide to the non-magnetic metal phase is more than 0 and 1.2 or less, and

wherein the non-magnetic metal phase and the oxide are mutually dispersed.

53. The target for magnetron sputtering according to ~~any one of~~ claim~~s~~ 1 ~~to~~ or 42, wherein a volume ratio of a magnetic metal phase having an aspect ratio of 2 or more among the magnetic metal phase is 0.5 or less to the total magnetic metal phase.

~~64~~. The target for magnetron sputtering according to any one of claims 1 to ~~53~~, wherein the non-magnetic metal phase has the atomic ratio of the metal Cr to the total of the metal Co and the metal Cr contained being 30 at% or more and less than 100 at%.

~~75~~. The target for magnetron sputtering according to any one of claims 1 to ~~64~~, wherein the magnetic metal phase comprises the metal Co and metal Cr with the balance being unavoidable impurities, and has an atomic ratio of the metal Co to the total of the metal Co and the metal Cr being 85% or more and less than 100 at%.

~~86~~. The target for magnetron sputtering according to any one of claims 1 to ~~64~~, wherein the magnetic metal phase consists of the metal Co and unavoidable impurities.

~~97~~. The target for magnetron sputtering according to any one of claims 1 to ~~86~~, wherein the oxide contains at least one of SiO_2, TiO_2, Ti_2O_3, Ta_2O_5, Cr_2O_3, CoO, Co_3O_4, B_2O_3, Fe_2O_3, CuO, Y_2O_3, MgO, Al_2O_3, ZrO_2, Nb_2O_5, MoO_3, CeO_2, Sm_2O_3, Gd_2O_3, WO_2, WO_3, HfO_2, and NiO_2.

~~108~~. The target for magnetron sputtering according to any one of claims 1 to ~~97~~, wherein the target can be used for forming a magnetic recording layer.

magnetic recording layer.

11. A manufacturing method for a target for magnetron sputtering, the method comprising the steps of:

mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%, the non-magnetic metal powder being produced by atomizing method and being classified to have a particle size of 106 μm or smaller, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder;

mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and

pressure sintering the obtained powder mixture for pressure sintering,

wherein no aggregated oxide having a longest diameter of 5 μm or larger is present in the obtained sintered product.

12. A manufacturing method for a target for magnetron sputtering, the method comprising the steps of:

mixing and dispersing non-magnetic metal powder and oxide

~~powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at%, the non-magnetic metal powder being produced by atomizing method and being classified to have a particle size of 106 μm or smaller, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder;~~

~~mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and~~

~~pressure sintering the obtained powder mixture for pressure sintering,~~

~~wherein no aggregated oxide having a longest diameter of 5 μm or larger is present in the obtained sintered product.~~

~~13~~9. A manufacturing method for a target for magnetron sputtering, the method comprising the steps of:

mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co and metal Cr with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal

Co and the other metals being more than 0 at% and 45 at% or less, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder;

mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and

pressure sintering the obtained powder mixture for pressure sintering.

~~14~~10. A manufacturing method for a target for magnetron sputtering, the method comprising the steps of:

mixing and dispersing non-magnetic metal powder and oxide powder to obtain a non-magnetic powder mixture, the non-magnetic metal powder containing metal Co, metal Cr, and metal Pt with an atomic ratio of the metal Cr to the total of the metal Co and the metal Cr being 25 at% or more and less than 100 at% and with an atomic ratio of the metal Co to the total of the metal Co and the other metals being more than 0 at% and 45 at% or less, the oxide powder being mixed at a volume ratio of more than 0 and 1.2 or less with respect to the non-magnetic metal powder;

mixing and dispersing the obtained non-magnetic powder mixture and magnetic metal powder containing metal Co to obtain a powder mixture for pressure sintering; and

pressure sintering the obtained powder mixture for pressure sintering.

~~15~~11. The manufacturing method for a target for magnetron sputtering according to ~~any one of~~ claim~~s 11 to 14~~9 or 10, wherein the method lacks the step of mixing and dispersing the magnetic metal powder with a ball mill.

~~16~~12. The manufacturing method for a target for magnetron sputtering according to any one of claims ~~11~~ 9 to ~~15~~11, wherein the non-magnetic metal powder has the atomic ratio of the metal Cr to the total of the metal Co and the metal Cr contained being 30 at% or more and less than 100 at%.

~~17~~13. The manufacturing method for a target for magnetron sputtering according to any one of claims ~~11~~ 9 to ~~16~~12, wherein the magnetic metal powder comprises the metal Co and metal Cr with the balance being unavoidable impurities, and has an atomic ratio of the metal Co to the total of the metal Co and the metal Cr being 85% or more and less than 100 at%.

~~18~~14. The manufacturing method for a target for magnetron sputtering according to any one of claims ~~11~~ 9 to ~~16~~12, wherein the magnetic metal powder consists of the metal Co and unavoidable impurities.

~~19~~15. The manufacturing method for a target for magnetron sputtering according to any one of claims ~~11~~ 9 to ~~18~~14, wherein the oxide contains at least one of SiO_2, TiO_2, Ti_2O_3, Ta_2O_5, Cr_2O_3, CoO, Co_3O_4, B_2O_3, Fe_2O_3, CuO, Y_2O_3, MgO, Al_2O_3, ZrO_2, Nb_2O_5, MoO_3, CeO_2, Sm_2O_3, Gd_2O_3, WO_2, WO_3, HfO_2, and NiO_2.

~~20. A target for magnetron sputtering obtained by the manufacturing method according to any one of claims 11 to 19.~~