

DESCRIPTION

Title of the Invention: SPUTTERING TARGET FOR MAGNETIC
RECORDING MEDIUM

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FIELD OF THE INVENTION

[0001]

The present invention relates to a sputtering target for a magnetic recording medium for forming a thin film composed of a Co-Pt-based alloy, and more particularly to a sputtering target for forming a thin film that has a granular structure composed of a Co-Pt-based alloy, and exhibits good magnetic separability between magnetic grains.

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DESCRIPTION OF THE RELATED ART

15 [0002]

The recording density of magnetic recording media, such as hard disk drives (HDDs), has rapidly increased conventionally, and the demand/trend for higher recording density are expected to continue in the future. In order to achieve higher recording density in magnetic recording media, perpendicular magnetic recording has been proposed. Furthermore, to improve recording density through the optimization of this recording method, it is preferable to reduce grain interaction with simultaneously refining magnetic grains contained in a magnetic thin film constituting a magnetic recording layer.

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[0003]

A magnetic thin film having a structure called a granular structure has attracted attention as one that reduces the grain interaction of magnetic grains (hereinafter, a magnetic thin film having a granular structure is referred to as a granular thin film). A granular thin film has a structure in which

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magnetic grains are dispersed in a non-magnetic material matrix of an oxide or the like, and reduces the grain interaction by non-magnetic grain boundaries formed by the oxide or the like. In a granular thin film, a plurality of magnetic grains form a recording bit. As the oxide constituting the non-magnetic grain boundaries of the magnetic recording layer to which such a granular thin film is applied, SiO₂, TiO₂, B₂O₃, and the like are known (Patent Documents 1 and 2).

[0004]

Generally, a magnetic thin film of a magnetic recording medium is often produced by a sputtering method. A granular thin film can also be produced by the sputtering method, in which a sputtering target containing an oxide along with an alloy or metal of Co, Pt or the like that constitutes a magnetic material is applied (for example, Patent Documents 3 and 4). Besides, in the formation of the granular thin film, an underlayer composed of Ru, a Ru-containing alloy or the like which has the effect of promoting epitaxial growth of the magnetic grains, is applied. The granular thin film is formed by two-phase deposition of the magnetic grains and the oxide (non-magnetic grain boundaries) by sputtering onto the surface of the underlayer using the aforementioned sputtering target containing the oxide.

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Prior Art Document

Patent Document

[0005]

Patent Document 1

25 Japanese Patent Application Laid-Open No. 2002-83411

Patent Document 2

Japanese Patent Application Laid-Open No. 2001-43526

Patent Document 3

Japanese Patent No. 5032706

Patent Document 4

Japanese Patent No. 6317636

5 SUMMARY OF THE INVENTION

Technical Problem

[0006]

As stated at the beginning, the refinement of magnetic grains is effective for increasing the recording density in a magnetic recording medium. The refinement of magnetic grains in a granular thin film can be achieved by increasing the oxide content in the sputtering target. The increase in the oxide content increases the thickness of the non-magnetic grain boundaries to make the boundaries more distinct, and thus, a granular thin film in which the magnetic grains are dispersed and separated can be formed.

[0007]

However, the increase in recording density is achieved not only by the refinement of magnetic grains but also by improvement of separability between recording bits constituted by groups of these magnetic grains. The term "separability" here refers to magnetic separability. Although the increase in the oxide content refines the magnetic grains and increases the thickness of the non-magnetic grain boundaries, this does not directly lead to the improvement in the magnetic separability of the granular thin film.

Considering that a recording bit is composed of a plurality of magnetic grains, the magnetic separability of the entire thin film should be ensured by examining not only the amount of the oxide (non-magnetic grain boundaries) but also the effect of the composition.

[0008]

Besides, while the increase in the amount of the oxide in a granular thin film can achieve the refinement of magnetic grains, the amount increase of the oxide inevitably leads to a decrease in the volume ratio of the magnetic grains. The decrease in the volume ratio of the magnetic grains reduces the overall magnetization of the granular thin film, which can lead to a reduction in signal strength in reproduction of the recording medium. Therefore, although the oxide in a granular thin film is an essential component, the content cannot be arbitrarily increased.

[0009]

The present invention has been made to address the above-mentioned issues, and relates to a sputtering target for a magnetic recording medium, which is used to produce a magnetic thin film containing a Co-Pt-based alloy, that is, one of magnetic thin films most frequently applied to magnetic recording media. Thus, the present invention provides a sputtering target capable of forming a granular thin film with good magnetic separability. To address this problem, the present inventors have decided to find a method capable of optimizing the oxide content with magnetic properties, including magnetic separability, simultaneously ensured.

Solution to Problem

[0010]

According to the studies conducted so far by the present inventors, the magnetic properties of a granular thin film vary depending on the type of oxide that constitutes the non-magnetic grain boundaries. Since these magnetic properties are considered to include magnetic separability, it is deemed that even with the same content, a difference in magnetic separability will arise depending on the type of oxide. Furthermore, various

magnetic properties in a magnetic thin film may be mutually contradictory, and as a result of improving one property, the other property may deteriorate.
[0011]

One of the most fundamental evaluation methods for magnetic recording media is a *M-H* hysteresis loop. By measuring a *M-H* hysteresis loop, the saturation magnetization (M_s) and the perpendicular coercivity (H_c) of a magnetic thin film can be determined. The magnetic separability of a granular thin film can also be determined based on a *M-H* hysteresis loop, and can be determined using an α value, which represents the slope of the magnetization curve near the coercivity (near $M = 0$) (i.e., $4\pi \times (dM/dH)$). The α value increases as the magnetic separability between recording bits decreases, and when the α value being closer to 1, the magnetic separability is considered to be better.

[0012]

To solve the above-mentioned problem, the present inventors have decided to investigate an oxide that can improve the magnetic separability of a granular thin film while maintaining the saturation magnetization (M_s) that is a fundamental property of a magnetic thin film. As a result, it has been found that an oxide of W (tungsten) and an oxide of Mo (molybdenum) can be used to obtain a magnetic thin film having a low α value and good magnetic separability even at a relatively low content, and thus, the present invention has been conceived.

[0013]

Specifically, the present invention is dawn to a sputtering target for a magnetic recording medium containing Co and Pt as metal components, and at least one oxide, in which a tungsten oxide and/or a molybdenum oxide are contained as an essential oxide, and a content of the essential oxide is 15 vol% or less.

[0014]

The configuration and production method of the sputtering target for a magnetic recording medium of the present invention will now be described.

[0015]

5 A Configuration of Sputtering Target for Magnetic Recording Medium of Invention

(i) Metal Component

As described above, the sputtering target for a magnetic recording medium of the present invention contains metal components of Co and Pt as
10 essential components. Co is a ferromagnetic metal, and is a main component of Co-Pt-based alloy grains corresponding to magnetic grains of a granular thin film constituting a magnetic recording layer. Pt is a paramagnetic metal, has a large spin-orbit interaction, and improves the magnetic anisotropy by alloying with Co that is ferromagnetic. Pt is also a metal used as an essential
15 component of the Co-Pt-based alloy grains working as the magnetic grains.

[0016]

A preferable composition for the Co-Pt-based alloy grains constituting the magnetic recording layer is 60 at% or more and 95 at% or less of Co for optimizing the uniaxial magnetic anisotropy constant K_u . Accordingly, it is
20 preferable that the content of Co with respect to all the metal components is 60 at% or more and 95 at% or less in the sputtering target for a magnetic recording medium of the present invention. The term "metal components" refers to Co and Pt, and other metals if other metal components described below are contained. A metal component of the oxide is excluded. The
25 content of Co with respect to all the metal components is more preferably 70 at% or more and 90 at% or less.

[0017]

The magnetic grains constituting the magnetic recording layer are a Co-Pt-based alloy containing Co and Pt as essential metals, and may also contain other metals. Examples of the other metals include Cr, Ru, and B. These metal elements can be added because these have effects of adjusting the saturation magnetization M_s and improving the magnetic separability of the magnetic grains. The Co-Pt-based alloy used in the magnetic grains of the magnetic recording layer may contain these metals in a content of 20 at% or less. Accordingly, the sputtering target of the present invention may contain the other metals in a content of 20 at% or less with respect to all the metal components. It is noted that the content of Pt with respect to the metal components corresponds to the remainder of the contents of Co and the other metals.

[0018]

In the sputtering target for a magnetic recording medium of the present invention, the metal components of the metal Co and the metal Pt may exist as single metals, or may exist in the form of an alloy (Co-Pt-based alloy). The same applies to the other metal components such as Cr.

[0019]

(ii) Oxide (Essential Oxide and Additional Oxide)

The sputtering target for a magnetic recording medium of the present invention contains at least one oxide for forming non-magnetic grain boundaries of a granular thin film. In the present invention, a tungsten oxide and/or a molybdenum oxide are contained as an essential oxide. A granular thin film formed using a sputtering target containing a tungsten oxide and/or a molybdenum oxide exhibits a low α value and good magnetic separability even with a relatively small oxide content. Here, the saturation magnetization M_s also maintains a relatively high value. The reason why the granular thin film containing a tungsten oxide and a molybdenum oxide exhibits good

magnetic separability (α value) is unknown, but this fact has been determined based on the results of screening performed by the present inventors described later.

[0020]

5 In a magnetic thin film composed of the Co-Pt-based alloy, the tungsten oxide and the molybdenum oxide corresponding to the essential oxide can significantly reduce the α value even when added in a minute amount (more than 0 vol%). As the content of the essential oxide increases, the α value decreases and approaches 1. However, the effect of reducing the
10 α value diminishes when the essential oxide content exceeds 15 vol%. Therefore, in the present invention, the content of the essential oxide is set to 15 vol% or less with respect to the total volume of the target. The upper limit of the content of the essential oxide may be 13 vol% or less, 10 vol% or less, or 8 vol% or less. The lower limit of the content of the essential oxide is
15 preferably 0.5 vol% or more, more preferably 1.0 vol% or more, and further preferably 2.0 vol% or more.

[0021]

The sputtering target of the present invention must contain either tungsten oxide or molybdenum oxide, which are essential oxides.

20 Alternatively, the sputtering target may contain both tungsten oxide and molybdenum oxide. When both tungsten oxide and molybdenum oxide are contained, the total content must be 15 vol % or less.

[0022]

25 In the present invention, the tungsten oxide contained in the sputtering target is WO_3 and/or WO_2 , and the molybdenum oxide is MoO_3 and/or MoO_2 . For example, even when a sputtering target is produced using WO_3 as a raw material, a portion of the material may be reduced to WO_2 , and in such a case, the sputtering target may contain both WO_3 and WO_2 . The tungsten

oxide and molybdenum oxide contained in the present invention also encompass such cases where oxides with different valencies of tungsten and molybdenum are mixed.

[0023]

5 As long as the sputtering target for a magnetic recording medium of the present invention essentially contains the tungsten oxide and/or the molybdenum oxide, another oxide, different from these oxides, may be optionally contained as an additional oxide. Specific examples of the additional oxide include B_2O_3 , SiO_2 , TiO_2 , Cr_2O_3 , CoO , and Co_3O_4 . Such
10 additional oxides form non-magnetic grain boundaries by complexing with the essential oxide.

[0024]

 Among the additional oxides mentioned above, B_2O_3 is preferably added together with the essential oxide. A granular thin film containing B_2O_3
15 in the non-magnetic grain boundaries is liable to lead to an increase in the uniaxial anisotropy constant K_u . The uniaxial anisotropy constant K_u is related to the resistance of the magnetic thin film to thermal fluctuations (thermal stability). This thermal stability is evaluated by a product of the uniaxial anisotropy constant K_u and the activation volume V_a (or the volume V of a
20 magnetization reversal unit). Since the increase in the uniaxial anisotropy constant K_u increases the value of the aforementioned product, the addition of B_2O_3 to the granular thin film contributes to the improvement of thermal fluctuation resistance.

[0025]

25 Besides, regarding the additional oxides other than B_2O_3 , SiO_2 has the effect of making the non-magnetic grain boundaries amorphous. TiO_2 has the effect of preventing segregation to the magnetic grains due to oxygen deficiencies because Ti possesses multiple valencies. Besides, Cr_2O_3 , CoO ,

and Co_3O_4 have the effect of compensating for oxygen deficiencies at the grain boundaries. Which of these additional oxides is contained in the sputtering target of the present invention can be appropriately selected depending on required properties of the magnetic thin film to be formed.

5 [0026]

When the sputtering target for a magnetic recording medium of the present invention contains the essential oxide (the tungsten oxide and/or the molybdenum oxide) and the additional oxide (e.g., B_2O_3 , SiO_2 , TiO_2 , Cr_2O_3 , CoO , and Co_3O_4), the total content of the essential oxide and the additional
10 oxide (total oxide content) is preferably 20 vol% or more and 50 vol% or less. This is to form a granular structure with ensured magnetic separability, and to ensure signal strength in reproduction of the recording medium. When the additional oxide is thus contained, the content of the essential oxide is preferably 15 vol% or less.

15 [0027]

Besides, the effect of reducing the α value possessed by the essential oxide is not inhibited by the additional oxide. In the present invention, when the additional oxide is contained, the content of the essential oxide can be 10 vol% or less, 8 vol% or less, or 5 vol% or less within the range of the total
20 oxide content described above. This suggests that the tungsten oxide and/or the molybdenum oxide used as the essential oxide is useful for the purpose of reducing the total oxide content and ensuring the proportion of the magnetic component. In this case, the lower limit of the content of the essential oxide is preferably 0.5 vol% or more, more preferably 1.0 vol% or
25 more, and further preferably 2.0 vol% or more.

[0028]

B Method for Producing Sputtering Target for Magnetic Recording Medium of Invention

The sputtering target of the present invention contains a metal phase (a Co-Pt-based alloy phase, or a metallic Co phase and a metallic Pt phase) composed of the metal components described above, and an oxide phase (an essential oxide phase and an additional oxide phase). As for a production method of such a sputtering target, the application of powder metallurgy is preferred for uniformly dispersing the oxide phase within the metal phase. In employing the powder metallurgy, the sputtering target can be produced by mixing a metal powder for forming the metal phase with an oxide powder, appropriately molding the resultant mixture, and then performing pressure sintering.

[0029]

As the metal powder, an alloy powder containing a Co-Pt-based alloy, or a metal Co powder and a metal Pt powder can be applied. The alloy powder can be produced from a melt of the Co-Pt-based alloy having the above-described composition by an atomization method such as gas atomization. When the metal Co powder and the metal Pt powder are applied, commercially available powders of the respective metals can be used, and in this case, it is preferable to use high-purity products. Then, in a mixing step described later, the metal Co powder and the metal Pt powder are mixed so as to achieve the above-described composition. In the production of the sputtering target of the present invention, a metal powder having a particle size of 100 μm or less is preferred.

[0030]

These metal powder and oxide powder are thoroughly mixed before sintering to obtain a mixed powder. For this mixing process, mixing and dispersion means such as a ball mill, a bead mill, or a rocking mill can be applied. The mixed powder obtained with these mixing means may be

subjected to preliminary molding before pressure sintering process in the next step.

[0031]

Then, the sputtering target of the present invention can be obtained by appropriately molding the mixed powder and subsequently subjecting the resultant to pressure sintering. For the sintering means used at this time, hot pressing (HP), hot isostatic pressing (HIP), spark plasma sintering (SPS), or the like can be applied. A sintering temperature employed in the pressure sintering is preferably 600°C or more and 1500°C or less, and a pressure applied is preferably 10 MPa or more and 200 MPa or less. Besides, the heating atmosphere is preferably vacuum or a non-oxidizing atmosphere.

Advantageous Effects of Invention

[0032]

As described so far, the sputtering target of the present invention makes it possible to form a magnetic thin film having a granular structure with excellent magnetic separability with saturation magnetization maintained. In the present invention, based on the viewpoint of magnetic separability, a tungsten oxide and/or a molybdenum oxide are applied as an essential oxide forming non-magnetic grain boundaries of a granular thin film. Besides, the sputtering target of the present invention is allowed to contain, in addition to the essential oxide, an oxide such as B_2O_3 as an additional oxide. This makes it possible to set a favorable oxide content while balancing the improvement of magnetic properties, such as the uniaxial anisotropy constant K_u , and the magnetic separability. Optimization of the oxide content leads to optimization of the proportion of the magnetic component in the magnetic thin film and ensuring magnetization.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033]

Fig. 1 shows graphs showing measurement results of an α value and M_s depending on an oxide content in a magnetic film formed using a sputtering target produced in First Embodiment (75 at% Co-25 at% Pt + oxide);

Fig. 2 shows graphs showing measurement results of an α value and M_s depending on an oxide content in a magnetic film formed using a sputtering target produced in Second Embodiment (80 at% Co-20 at% Pt/20 vol% B₂O₃ + oxide); and

Fig. 3 shows graphs showing measurement results of an α value and M_s depending on an oxide content in a magnetic film formed using a sputtering target produced in Second Embodiment (80 at% Co-20 at% Pt/30 vol% B₂O₃ + oxide).

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034]

First Embodiment: A preferred embodiment of the present invention will now be described. In the present embodiment, sputtering targets in which various oxides (WO₃, MoO₃, B₂O₃, SiO₂, TiO₂, and Cr₂O₃) were added to a Co-Pt alloy (75 at% Co-25 at% Pt) were produced. Then, magnetic thin films were formed using these sputtering targets, and M - H hysteresis loops were measured to evaluate saturation magnetization M_s and an α value for magnetic separability.

25 [0035]

In the production of the sputtering targets, first, metal Co and metal Pt were weighed and melted at 1500°C or more to prepare an alloy melt of a Co-Pt alloy (75 at% Co - 25 at% Pt). Then, an alloy powder was produced

from this alloy melt by gas atomization. Thereafter, the resultant was subjected to a classification process to obtain a Co-Pt alloy powder (75 at% Co-25 at% Pt alloy powder) having an average particle size of 100 μm or less.

5 [0036]

The Co-Pt alloy powder thus obtained was mixed with each of various oxide powders (of WO_3 , MoO_3 , B_2O_3 , SiO_2 , TiO_2 , and Cr_2O_3). The Co-Pt alloy powder was mixed with the oxide powders through a treatment with a ball mill (grinding media: ceramic balls).

10 [0037]

Then, the mixed powders thus obtained were pressure sintered to produce the sputtering targets. The pressure sintering was performed by hot pressing at a sintering temperature of 920°C and a pressure of 24.5 MPa for a pressure sintering time of 30 min in an atmosphere of a vacuum condition of 5×10^{-2} Pa or less. Each sputtering target thus produced had dimensions of 180 mm in diameter and 5 mm in thickness, with a relative density in the range of 95% to 100%.

[0038]

20 In the present embodiment, the sputtering targets respectively containing, as an oxide, WO_3 , MoO_3 , B_2O_3 , SiO_2 , TiO_2 , and Cr_2O_3 , and having a content of the oxide set to 2.5 vol% to 40 vol% were produced, and properties of magnetic thin films with respect to the type and contents of the oxides were evaluated.

[0039]

25 Next, each of the respective sputtering targets thus produced was used to form a magnetic thin film (granular thin film). As a substrate of the magnetic thin film, a glass substrate having a layer configuration of Ni-Ta (60 nm)/90 Ni-10 W alloy (6 nm)/Ru (25 nm)/Co Cr Ru- TiO_2 (2 nm) was used.

The magnetic thin film was formed with a sputtering apparatus (at Ar gas pressure of 1 to 5 Pa, and a temperature of room temperature to 250°C), targeting a film thickness of 4 to 16 nm. After forming the magnetic thin film, a C thin film (7 nm) was sputtered as a protective layer for the magnetic thin film to obtain a sample for magnetic property evaluation.

[0040]

For the evaluation of the magnetic properties of the magnetic thin films, a M - H hysteresis loop was measured with a vibrating sample magnetometer (VSM). For the M - H hysteresis loop obtained for each type and content of the oxide, saturation magnetization M_s was calculated, and an α value of the slope near $M = 0$ was calculated.

[0041]

Fig. 1 shows the measurement results of the α value indicating the magnetic separability and the saturation magnetization M_s of the magnetic thin films formed using the 75 at% Co-25 at% Pt alloy targets containing the various oxides (WO_3 , MoO_3 , B_2O_3 , SiO_2 , TiO_2 , and Cr_2O_3). In Fig. 1, values obtained in a magnetic thin film (75 at% Co-25 at% Pt) containing no oxides ($X = 0$ vol%) are shown with dashed lines.

[0042]

Referring to Fig. 1, the α value fundamentally decreases and approaches 1 as the content increases for all the oxides. However, the magnetic thin film containing WO_3 and MoO_3 as the oxide shows a remarkable effect of reducing the α value starting from the minimum content (2.5 vol%) examined in this embodiment. It is deemed that the tungsten oxide and the molybdenum oxide are effective as the essential oxide for reducing the α value of the granular thin film, even with addition in a small amount. Furthermore, considering the saturation magnetization M_s , which is liable to

decrease with an increase of the oxide content, it was confirmed that the content of the essential oxide is preferably 15 vol% or less.

[0043]

5 Second Embodiment: In the present embodiment, a magnetic thin film containing a Co-Pt alloy (80 at% Co-20 at% Pt) and B_2O_3 was used as a basis, and sputtering targets were produced for forming magnetic thin films with various oxides added to this basis. Specifically, the present embodiment examined the magnetic separability obtained by adding an oxide to a granular thin film formed by previously adding B_2O_3 .

10 [0044]

The method for producing the sputtering target was basically the same as that of First Embodiment. A Co-Pt alloy powder was prepared from a Co-Pt alloy (80 at% Co-20 at% Pt alloy) melt by gas atomization, and this Co-Pt alloy powder was mixed, with a ball mill, with a B_2O_3 powder and an oxide powder of various oxides (WO_3 , MoO_3 , B_2O_3 , SiO_2 , TiO_2 , and Cr_2O_3). Then, the resultant mixed powder was pressure sintered by hot pressing to produce a sputtering target having a relative density within the range of 95% to 100%.

[0045]

20 In the present embodiment, two types of basic configurations for the sputtering target were set. The first basic configuration was a target containing the Co-Pt alloy (80 at% Co-20 at% Pt) and 20 vol% B_2O_3 , and the second basic configuration was a target containing the Co-Pt alloy (80 at% Co-20 at% Pt) and 30 vol% B_2O_3 . In the present embodiment, each of WO_3 , MoO_3 , B_2O_3 , SiO_2 , TiO_2 , and Cr_2O_3 was added, with the content varied, to each of these two basic configurations to produce a plurality of sputtering targets.

[0046]

Thereafter, the thus obtained various sputtering targets were used to form magnetic thin films in the same manner as in First Embodiment. The substrate configuration and the film forming conditions were the same as those in First Embodiment. Besides, the measurement of a $M-H$ hysteresis loop that is the evaluation method for a magnetic thin film sample thus prepared was performed also in the same manner as in First Embodiment. [0047]

Regarding the evaluation results, Fig. 2 shows the α value and M_s obtained by adding the various oxides to the first basic configuration of 80 at% Co-20 at% Pt/20 vol% B_2O_3 . Fig. 3 shows the α value and M_s obtained by adding the various oxides to the second basic configuration of 80 at% Co-20 at% Pt/30 vol% B_2O_3 . These graphs also show the respective values of magnetic thin films (80 at% Co-20 at% Pt/20 vol% B_2O_3 and 30 vol% B_2O_3) before adding the various oxides ($X = 0$ vol%). [0048]

It is understood from Figs. 2 and 3 that the Co-Pt alloy magnetic film containing the additional oxide (B_2O_3) considered in the present embodiment shows a significant decrease in the α value by containing WO_3 or MoO_3 . This embodiment presents the evaluation results obtained by adding WO_3 or MoO_3 , or these different oxides to the sputtering target containing B_2O_3 as the additional oxide. WO_3 and MoO_3 are superior to the other oxides in terms of the effect of improving the magnetic separability. This tendency is similar to the one shown in First Embodiment. [0049]

In addition, it was confirmed that also in the sputtering target containing the additional oxide such as B_2O_3 , even a small amount of the tungsten oxide and the molybdenum oxide can exhibit the effect of reducing the α value. Besides, in the present embodiment, it was also confirmed that

the sputtering target of the present invention can have a sum of the content of the essential oxide and the content of the additional oxide (total oxide content) in the range of 20 vol% or more and 50 vol% or less.

[0050]

5 As described above, B_2O_3 has the effect of both forming the non-magnetic grain boundaries of the granular thin film and improving the uniaxial anisotropy constant K_u . Therefore, the necessity of mixing the additional oxide such as B_2O_3 in the sputtering target is anticipated, which can consequently lead to a higher oxide content in the magnetic thin film
10 (sputtering target). It is considered that the tungsten oxide and the molybdenum oxide are both useful as additives for improving the magnetic separability when mixed in small amounts in such a magnetic thin film (sputtering target).

Industrial Applicability

15 [0051]

 As described so far, the sputtering target of the present invention is effective for forming a magnetic thin film with excellent magnetic separability in formation of a magnetic thin film having a granular structure. The sputtering target of the present invention may contain an additional oxide
20 such as B_2O_3 in addition to an essential oxide, that is, a tungsten oxide and/or a molybdenum oxide. In this case, the tungsten oxide and the molybdenum oxide used as the essential oxide can function as a small-amount additive to the additional oxide such as B_2O_3 . Thus, the oxide content in the sputtering target, and consequently in the magnetic thin film can be
25 optimized, and hence the magnetization of the magnetic thin film can be ensured. The sputtering target of the present invention is particularly suitable for formation of a magnetic thin film by the perpendicular magnetic recording, in which the density has been remarkably increased.

WHAT IS CLAIMED IS:

Claim 1.

A sputtering target for a magnetic recording medium, comprising Co and Pt as metal components, and at least one oxide,

- 5 wherein the sputtering target comprises a tungsten oxide and/or a molybdenum oxide as an essential oxide, and
a content of the essential oxide is 15 vol% or less.

Claim 2.

- 10 The sputtering target for a magnetic recording medium according to claim 1, comprising, in addition to the essential oxide, an oxide different from the essential oxide as an additional oxide.

Claim 3.

- 15 The sputtering target for a magnetic recording medium according to claim 2, wherein the additional oxide is B₂O₃, SiO₂, TiO₂, Cr₂O₃, CoO, or Co₃O₄.

Claim 4.

- 20 The sputtering target for a magnetic recording medium according to claim 2 or 3, wherein a total oxide content being a sum of a content of the essential oxide and a content of the additional oxide is 20 vol% or more and 50 vol% or less, and
the content of the essential oxide is 15 vol% or less.

25